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THE DEVELOPMENT OF UGANDA.

A book entitled PLANTING IN UGANDA * recently published, though primarily written for settlers and investors interested in Uganda will be welcomed in all planting circles as an important contribution to the literature of Tropical Agriculture and, as it contains an introduction by PROFESSOR DUNSTAN, it will be accepted as possessing authority. Planters in the East who are turning their attention again to coffee will find in it a very useful and much needed account of the cultivation and preparation of this product written by men who evidently understand their business. The book is not arranged under product headings but under plantation operations, a system somewhat inconvenient for an established planter but with obvious advantages for a settler in a new country.

Investors acquainted with conditions of the East will wonder whether a country with rainfall under 60 inches and an elevation of 4,000 feet can have a future for the planting of Hevea, but as the authors remark Uganda is nearer the equator than Ceylon or Malaya, a circumstance that would tend to neutralize to some extent the effect of elevation. Rainfall again should be estimated in relation to elevation ; that is to say 50 inches at 4,000 feet would be equivalent to perhaps 70 or more at sea level. "As regards moisture," they write, "we have splendid advantages in the presence of huge lakes to supply moisture to the air." But

* PLANTING IN UGANDA: COFFEE, PARA RUBBER, COCOA by E. BROWN, F.L.S., and H. H. HUNTER, LL.D., with contributions by PROFESSOR DUNSTAN, C.M.G., and GEORGE MASSEE, F.L.S.—Longmans. **Rs. 8.**

while they have lakes we have oceans. There are as yet no records showing what plantations of Hevea in Uganda actually yield, but the authors after examining the results of various experimental tappings conclude that 1 lb. of rubber per annum may be expected from 5-year old and 2 lb. from 8-year old trees. In one case 164 trees, presumably 8 years old, yielded 13 ozs. of dry rubber per tree in 3 months ; in another an average of 5·13 ozs. of dry rubber per tree was obtained in 3 months on a plantation of 5-year old trees on which 1,800 trees per month had been tapped. We think that the expectation of 2 lb. per tree per annum sustained through renewed bark scarcely justified from data available as yet. The authors advocate the basal V system of tapping for young trees, two V's for older. These systems are being abandoned in Ceylon in favour of one cut on half or third circumference at an angle of 15° or less, not 45° as stated in this book. Considering the interests likely to be involved we think it would be worth while for Uganda to send a representative to study the methods of planting, tapping and preparation adopted in Ceylon, so that full advantage may be taken of the experience that has been gained here. The authors state there is no certain advantage in smoking rubber as compared with creping, overlooking the capital expense saved in being able to dispense with creping machinery. It is probable that in the East smoked sheet is made on the majority of new estates opened.

There are over 9,000 acres under Arabian coffee in Uganda, and judging by the photographs reproduced in this book the country has in coffee found a product, provided it can ward off leaf disease which has now made its appearance. Arabian Coffee in Uganda is not shaded, but if leaf disease makes progress it might be prudent to consider the advisability of providing light shade for the plantations.

In his chapter on Diseases caused by Fungi MR. MASSEE states that "It has been demonstrated that coffee trees grown in the open are less susceptible to the disease (*Hemileia vastatrix*) than those grown in the shade." This is not in accordance with our experience here where we find that trees grown under light shade like that afforded by *Leucœna glauca* suffer less from leaf disease than those fully exposed. In his third report on Coffee

Leaf disease published as a Ceylon Sessional Paper in 1881, MR. MARSHALL WARD stated: "There can be no question that coffee under artificial shade is spared a large infliction of wind-blown spores.....it becomes an important question how far the visitations of *Hemileia* could be checked by belts of trees or other shelter. It is a matter for regret that such immense, unbroken areas of coffee exist without break of any kind, and one can trace the swaying backwards and forwards of the spore-laden winds in consequence."

The authors of the volume under notice, MESSRS. E. BROWN and H. H. HUNTER, pioneers, as PROFESSOR DUNSTAN tells us, in the agricultural development of the country, speak with confidence of the prospects for Cocoa which is in a more elementary state of development than even Hevea rubber, and when corrections for latitude and elevation are made this confidence would seem to be well justified. Though the rainfall is not abundant it is well distributed and there is no long dry season. No mention is made of tobacco, but we shall be surprised if this product does not in the future claim attention by Uganda planters.

R. N. L.

SCHOOL GARDENS AND THE PLANTING OF VEGETABLE PRODUCTS.

The value of school gardens as agencies through which to reach villagers was demonstrated in a striking manner in the latter part of the year, when, there appearing to be some likelihood of our food supplies being interrupted through the depredations of enemy cruisers, it seemed desirable to encourage as much as possible the planting of vegetables in the villages. Steps were taken to distribute through the medium of the school gardens, of which we have now over 280 in various parts of the Island, seeds and cuttings in time for planting in the north-east monsoon rains, and this was successfully accomplished, thanks chiefly to the energies of MR. DRIEBERG and the staff under him. In three weeks (October 24th to November 14th) 13,318 packets of seed, 6 cwt. of sweet potatoes, 6,100 cuttings of yams, 6 maunds of potatoes, 200 lb. of yams, and 200 lb. of sorghum seed were sent out. Distribution continued to the end of the year. A great deal of planting was done, independently of supplies from Peradeniya, by the people, many of whom were fully alive to the possibility of an increased demand for vegetable products arising in the markets, so that altogether a considerable addition was made to the food supply of the Island and to the resources of seed and cuttings for future seasons.—ANNUAL REPORT OF THE DIRECTOR OF AGRICULTURE, CEYLON, 1914.

COCONUTS.

CEYLON COCONUT INDUSTRY, 1914.

On the outbreak of war a serious though brief slump occurred in the market, prices falling to Rs. 30 per candy for a few parcels. They speedily recovered, the price ruling at Rs. 77 in December, as against Rs. 97 in January. Restrictions upon exports by enemy subjects, who were large local buyers, induced some planters to ship direct to London. The loss in weight proved negligible, and there seemed to be a possibility of commanding a better market. In the case of one group of estates I am aware of, that took this course, an average of approximately £25 per ton (equal to, say, Rs. 93·75 per candy) was obtained in London for all shipments after the war. To pack for export bags should show an even nett weight. Cultivation, in which I include manuring, is apt to wax and wane with the rise and fall of copra, but on the whole a better standard of cultivation has, I think, been maintained, due to some extent to a plentiful supply of labour. Planters are in some cases realizing the good effect of clean weeding and digging or ploughing on crop production. In the drier districts crops suffer mainly from want of rain. It should, therefore, be the object of the planter to conserve the rain he gets, which is often ample in quantity but badly distributed. This he can do by preventing his land from getting hard, the most favourable condition for the soil to be in for evaporating moisture.

EXPERIMENTS.

The problems, which the experiments now in progress are intended to determine may be set out as follows :

At Peradeniya (Wet Zone).—The effect of the chief manurial constituents alone and in combination, as well as that of simple treatment available to the villager upon old trees. These experiments are being conducted with 15 plots, and were started in 1911.

The influence of nitrogen, phosphoric, and potash on the yields of nuts, six plots each of four trees (bearing) having been selected so that the experiment may be duplicated. Manures have not yet been applied.

The up-bringing of a young plantation by means of the plough and the harrow alone—a young plantation consisting of 10 acres planted in 1907.

At Maha Iluppalama (Dry Zone).—The up-bringing of a young plantation by means of the plough and the harrow (i.e., on dry farming principles). This experiment is on a more extensive scale than the corresponding one at Peradeniya, and consists of two plots: one (A) of 17 acres planted in 1909, and the other (B) 6½ acres planted in 1908. Plot (B) acts as a control, and has not been cultivated, but only weeded; (A) has had water turned on about twice a year to soften the ground before ploughing.

At Chilaw (Semi-Dry Zone).—The influence of the principal manurial ingredients, and of cultivating the land and keeping it stirred with the hoe (dry-farming) upon a plantation in full bearing on rather poor soil. This ground, which is 15 acres in extent and divided into 13 plots, was established in 1914.

At Negombo (Wet Zone).—The effect of the principal manuring ingredients, in combination upon the up-bringing of a young plantation on poor sandy soil; 10 acres of land divided into 10 plots; trees planted in June, 1912; manures applied in June, 1914. This experiment is being conducted by MUDALIYAR A. E. RAJAPAKSE at his own expense under our direction.

At Pitakande, near Kurunegala (Wet Zone).—The effect of the principal manurial ingredients upon young trees in bearing (15 years old); 11 acres divided into 1 acre plots. This experiment was established under our advice by MR. C. E. COLLIN, of the North-Western Rubber Company, Ltd., in 1914.

Available Results.—Only in the case of 8 and 11 have the experiments been conducted over a sufficient length of time to permit of results being accepted. At Maha Iluppalama the effects of cultivation may be studied in three respects, namely, that of yield of nuts, of early bearing, and of quality of nuts, as set out in MR. HARBORD'S report.* The 17 cultivated acres are bearing in six years at the rate of 11½ nuts per tree; the 6½ acres uncultivated but weeded, at the rate of 2¾ nuts per tree in seven years; the proportion of bearing trees are respectively 29 and 12 per cent; the number of nuts required to produce a candy (560 lb) of copra 1,239 and 1,510. These results are without doubt of considerable value to coconut planters in dry districts, as they demonstrate that with intelligent husbandry the effect of a long dry season can be counteracted.

The old trees at Peradeniya, which have been under experiment, shed a large proportion of their nuts in the immature state, which, of course, were useless for copra, not an uncommon habit with old trees or trees on poor soil. The result of manuring and cultivation was to raise the yield from an average of 26 good nuts per tree in 1911 to 30 in 1913, the unmanured plots declining from 27 to 23. The number of immature nuts also showed a rise on the manured plots as might have been expected. Other results were the poor effect of nitrate of soda and of common salt on the yield of nuts, and the good effect of potash. The experiments also showed that ploughing twice a year was as beneficial as manuring.

CONSERVATION OF MOISTURE IN THE SOIL.

I have referred to some results that have been obtained at Maha Iluppalama with a young coconut plantation by keeping the land cultivated and not allowing it to cake. This subject is of the utmost importance to all planters and cultivators in Ceylon. The drawback to Chilaw and to some other parts of the Island is a long dry season, through which coconut trees struggle with their crops with difficulty. The rain that falls is sufficient in quantity but is badly distributed. The problem of how to provide moisture for the palm during the dry season is the urgent one in these regions, and overshadows all others. It should receive the closest attention on the part of those responsible for the management of estates. The problem is connected with the treatment of the land, which will differ in different localities. But the management of his land should claim the study of the planter quite as much as of the farmer in England, who knows that clay soils require different treatment from loam, and light from heavy. The problem of conserving the moisture of the soil may be summed up in an expressive phrase used to me by

* See *Report of the Manager, Dry Zone Experiment Station*, p. 150.

a visitor to Peradeniya, who referred to it as "kraaling the rain." First get your land into such a condition that the maximum amount of rain can enter it. Having kraaled your rain, maintain the land in such a condition that the bulk of the water cannot escape, except through the roots of the trees of the plantation. This is what is understood by dry farming. It is receiving more and more attention in Ceylon.—ANNUAL REPORT OF THE DIRECTOR OF AGRICULTURE, CEYLON, 1914.

RHINOCEROS BEETLE FUNGUS.

MR. G. BRYCE, who has charge of the experiments on this subject, reports as follows:—

Cultures of this fungus, *Metarrhizium anisoplioe* (Metsch) were brought to Peradeniya by DR. FRIEDERICHS of Samoa. Four fungi were tried in culture: one obtained in the Philippines, the second in the Malay States, the third in Hawaii, and the fourth in Samoa. No growth was obtained from the last two. A further supply of spores of the Samoan fungus was sent to Peradeniya by DR. FRIEDERICHS at a later date. This also failed to grow in culture tubes. The Philippine and Malay fungi have been kept established in pure cultures at Peradeniya. Laboratory experiments with these two fungi on the larvæ of the rhinoceros beetle show that they are parasitic on the larvæ but do not attack larvæ which are well grown and are kept under conditions nearly approximating their normal environment. Field experiments with the fungi in breeding traps for rhinoceros beetle are still in progress.—ANNUAL REPORT OF THE BOTANIST AND MYCOLOGIST, CEYLON, 1914.

COCONUTS AT MAHA ILUPPALAMA.

The plantations at Maha Iluppalama have made satisfactory progress during the year. The plots A and B referred to in this report consist of the following :—

Plot A.—17 acres of 6-year-old trees (ploughed and harrowed and growing on irrigable land).

Plot B.—6½ acres of 7-year-old trees (not ploughed and harrowed and growing on unirrigable land).

Number of trees per acre for all plots : 72.

Crop Returns.—Yield of nuts per tree per annum :—

		Plot A. Calculated from 10 yielding Months.		Plot B. Calculated from 9 yielding Months.
1913	...	3	...	0·5
1914	...	11·5	...	2·75

These yields are based upon the total number of trees, including those not yet in bearing.

Copra Returns.—Calculating from the yields of the first seven months*

* Owing to the rainy season the copra returns of the last five months were not available when this report was drawn up.

of the year 1914, the number of nuts required to produce a candy (560 lb.) of copra has been in the case of Plot A 1,239, and in the case of Plot B 1,510, with an average of 1,257 from the combined plots. The copra was well reported upon by Colombo brokers, and fetched top prices at the sales, in March Rs. 84 and in December Rs. 70 per candy.

Census of Trees.—The annual census of trees which have arrived at or are approximate to the yielding stage was taken in June, 1914, and the following figures were obtained :—

	Age.	Yielding.	Bearing.	Flowering.
Plot A ...	6 years ...	337 ...	355 ...	103
Plot B ...	7 years ...	43 ...	54 ...	30

Beetle Traps.—Traps consisting of pits excavated and filled with pieces of plantain stems, coconut stems, and other decaying vegetable matter, and covered with a layer of soil, the whole kept in a moist condition, were established in all the plantations. They proved useful in controlling the numbers of the black rhinoceros beetle.—ANNUAL REPORT OF THE MANAGER, DRY ZONE EXPERIMENT STATION, 1914.

"GRAY BLIGHT" OF COCONUTS.

Towards the end of the year complaints were received that "gray blight," the leaf disease caused by *Pestalozzia palmarum*, was more prevalent than usual. This disease is always prevalent to some extent on palms, tea, cinnamon, etc., and, except in the case of very young plants, does little damage. It is more abundant after the monsoon rains, and, being much more vigorous as a saprophyte than a parasite, it particularly affects palms which from any cause are in a condition of reduced vigour. It is now recognized that cultivated trees suffer much less from this disease than those which are not cultivated, and therein lies the remedy. Treatment with fungicides is obviously impossible, except in the case of very young plants.—ANNUAL REPORT OF THE BOTANIST AND MYCOLOGIST, CEYLON, 1914.

THE CHILAW COCONUT TRIAL GROUNDS.

THE EDITOR OF THE TROPICAL AGRICULTURIST.

DEAR SIR,

The account of the meeting of the Experiments Committee held on the 5th instant at "The Manor," Chilaw, as supplied to the OBSERVER by a Chilaw correspondent, is not authentic and is therefore not quite accurate.

MR. N. J. MARTIN not MR. SCHRADER stated that the plot chosen was, as regards bearing, about the worst on Millicent Estate. This does not, in my opinion, indicate want of fertility of the soil, but absence of its proper cultivation. The objection I took to experiments being conducted on fertile soil, at a previous meeting was, because it did not want long and costly experiments to prove that such soils could be made to yield handsome returns. I suggested that poor, hard, gravelly, or cabooky soils, on which coconuts now yielded little or no returns, if scientifically cultivated and made to yield good

crops, would attract more attention and be more profitable as object lessons, than experiments on fertile soils. I voiced this opinion at Peradeniya too and met with the support of all interested in coconuts. MR. LYNE did *not* say "that it would be no use experimenting on utterly bad soil of which nothing could be made." He explained that the object of the present experiments was to find out the most suitable manure for coconuts and that he quite understood and sympathised with the suggestions I made and would endeavour to give effect to them.

What is meant by the experiment plot being "close to the residence of MR. MARTIN, the most experienced Planter in the District? This is a guarantee that no experiments will be 'allowed' which are not practicable to the ordinary Coconut Planter." The general belief is, that the experiments sub-committee decide on the experiments after much discussion and consideration.

The successful cultivation of coconuts on poor, white, sandy soils has long passed the experimental stage. The experiment on MUDALIYAR RAJAPAKSE'S estate is to find out the most suitable manure to bring plants on such soils into early maturity and bearing.

Truly yours,

A. W. BEVEN.

What about irrigation? Is it "practicable to the ordinary Coconut Planter?"

Negombo, 10th August, 1915.

A PEST OF COCONUTS.

(BRONTHISPA FROGATTI)

MR. W. DE COURCY BROWNE, of Kindar Estate, Hawthorn Sound, Solomon Islands, writes to us as follows :—This method [application of kerosene emulsion] of dealing with the pest has been generally discontinued for some considerable time in favour of "cutting out." It was found that simply using a wash or spray gave no definite results as the attacks of this pest are practically confined to the unfolded or partially unfolded leaf spathe.

The treatment now in general favour is by recourse to the knife—cutting out all the affected portions—thus removing beetle pupæ and eggs. The cut away portions are carefully collected by the boys employed on this work, handed over to one of the white staff at the end of the day for examination and then burnt. In addition, after cutting out has been accomplished a wash of arsenate of lead in combination with Bordeaux or any other wash for that matter is applied. If this treatment is systematically carried out the pest can be almost eliminated, or at any rate, checked so far, that harmful results are practically nil. With trees badly affected the cutting out causes rather a ragged appearance but otherwise apparently does not affect the tree in any way. Trees that have been systematically cut out for years show just as vigorous growth as trees that have been free from the pest. The attacks of the pest are not confined to trees of any particular age—plants in the nursery are just as liable to attack as old bearing trees.

RUBBER.

NODULES IN HEVEA.

MR. G. BRYCE, Assistant Botanist and Mycologist, who has been occupied with the investigation of nodules in Hevea, reports as follows:—

The work undertaken early in the year yielded confirmatory evidence of the results originally obtained by BATESON in the F. M. S. In the great majority of nodules examined there was a central core of latex tubes containing caoutchouc. With these occur a few layers of cells of the original cortex, some of which have a dark brown or blackish compact content. Similarly coloured streaks occur apparently in intercellular spaces. A few nodules had no discernible central core of latex tubes. The walls of the latex tubes and accompanying cortical cells gave the lignin reactions with various stains. The brown discolouration appears to be due to a tannin which has undergone some change ; it is insoluble in 90 per cent. alcohol, and resembles somewhat closely the product formed by the action of potassium bichromate on the tannin in normal Hevea bark.

Nodules were collected from an untapped, healthy tree on the Experiment Station, Gangaruwa. These had no central core of latex tubes with their accompanying cortical cells.

On an old Hevea tree in the Royal Botanic Gardens, Peradeniya, dead nodules were found in process of being shed in the dead scales of bark still adhering to the tree. Other nodules were observed in living connection with the cortex at only one small point of their surface. This would indicate that nodules are in certain cases shed in the normal shedding of bark.

The conditions leading to the formation of nodules in Hevea bark are still obscure.—ANNUAL REPT. OF THE BOTANIST AND MYCOLOGIST, CEYLON, 1914.

TREATMENT OF YOUNG RUBBER PLANTATIONS.

On the "Hilltop" (11 acres) and "Hillside" (7 acres) plantations the trees are now 18 months old, and have responded remarkably well to mulching from the interplanted *Tephrosia candida* sown 2 feet by 2 feet (6 lb. per acre). The bushes have been cut every two months to one foot from the ground, yielding about 3 tons per cutting or 18 tons per year.

Plots 73 to 76 (2 acres, planted in avenues of 40 feet by 15 feet by 15 feet (112 trees per acre), trees 18 months old, have been kept well disc-harrowed during the dry weather. *Crotalaria incana* sown in drills in June has been cut and mulched to the trees after forking round each. Plot 67 (1 acre) has been planted in June, 1914, with two-year old stumps from seed from old Peradeniya trees, in dynamited holes 33 feet by 33 feet and kept mulched with dadap and *Tephrosia candida*.

Plot 140 A (1 acre), behind the plant-breeding cage, planted in June, 1914, 33 feet by 33 feet in dynamited holes with two-year old stumps from No. 39 tree at Henaratgoda, a tree marked as a good yielder. The land being infested with Cora grass, sweet potato was sown to smother it out.

Plot 140 B (1 acre), tree 18 months old, planted 33 feet by 33 feet from stumps raised from seed of a black-seeded variety at Henaratgoda, mulched with *Tephrosia candida* and jungle stuff.

Plot 140 C trees 18 months old, planted 33 feet by 33 feet (half an acre) from stumps of a small-leaved variety at Henaratgoda. Mulched with *Crotalaria incana*.

Plots 14 and 15 of two-year old trees from No. 2 tree at Henaratgoda have been kept disced in the dry weather, and planted with *Indigofera arreela* in June, which has been twice cut and mulched to the trees.—ANNUAL REPT. OF THE MANAGER, EXPERIMENT STN., PERADENIYA, 1914.

PARASITE OF PRICKLY PEAR.

In January, 1913, DR. T. H. JOHNSTON, Lecturer in Biology at the University of Queensland, and MR. HENRY TYRON, Government Entomologist and Vegetable Pathologist of Queensland, visited Peradeniya to inquire into means used to destroy the prickly pear. They discovered at Matara the Ceylon wild cochineal insect (*Coccus indicus*) feeding on some prickly pear (*Opuntia monocantha*), which the inhabitants stated used to exist in great quantity, but for some reason which they could not explain was disappearing. They procured specimens of the plant and parasite, and a little breeding farm was established at Henaratgoda. At the same time the Northern Province prickly pear (*Opuntia dillenii*) was also planted. The insects established themselves on *Opuntia monocantha*, and two boxes of plants carrying a quantity of the scale were despatched to Brisbane early in 1914. At the time of writing the little patch of *Opuntia monocantha* has been almost exterminated by the parasite, but all efforts to establish it on *Opuntia dillenii*) have proved unavailing.—ANNUAL REPORT OF THE DIRECTOR OF AGRICULTURE, CEYLON, 1914.

THE OUTLOOK FOR TEA.

The demand for tea is increasing everywhere and growers are looking forward to particularly bright times. Already a large tea consuming country, Russia, will probably use more tea as a substitute for vodka. But apart from an increased demand from countries which hitherto have not absorbed large quantities of tea, a big consumption in the home market is virtually assured. The requirements of the Army alone are enormous, while the needs of the civilian population continue to grow. Although tea promises to be much dearer than it has been during the past few years, it is still, perhaps, the cheapest and most stimulating beverage obtainable, and its popularity is certainly not on the wane among the masses of the population:—THE GARDENERS' CHRONICLE.

COFFEE.

WILD COFFEE IN ABYSSINIA.

Coffee occurs in three main regions in Abyssinia, viz., in the East, in the South, and in the West, over which the climate is practically the same.

In the East, round the old Egyptian garrison town of Harrar, there are a few plantations established by Europeans, but the bulk of the coffee comes from bushes growing wild. The coffee bush in this region grows at an elevation of between 3,000 and 4,000 feet.

In the South, in the Arussi and Jimma districts, the coffee is uncultivated: it is found at an elevation of about 5,000 feet.

In the West, on the Western margin of the plateau, coffee occurs abundantly at an elevation of 6,000 feet.

There are no meteorological records obtainable for Abyssinia: outside the usual rain-gauge and thermometer found in the compounds of European houses in Adis Abeba the capital, there are no instruments in the whole country. The rainy season lasts from June to September, and in intensity rivals the South-west monsoon in Ceylon. October to March is the dry season; April and May are showery. Abyssinia forms part of the East African plateau: Southern Abyssinia is built up of igneous rocks, whose decomposition has yielded a rich laterite soil.

The coffee bushes occur in open park country, amongst tall trees, mostly evergreens, under whose shade the coffee bushes are most numerous. The soil is covered with grass in open spaces, where the coffee bushes are wanting, and affords good grazing for cattle.

The coffee crop is the monopoly of the Abyssinian Government, who sell it to Greek traders. These latter buy at about 2¼ Maria Theresa dollars per frasula of 37½ lb.: this is equivalent to £0. 14*s*. 0*d*. per hundredweight.

The coffee crop from the Eastern side is exported through the French port of Djibouti, and put on the market at Mocha as "Long Berry Mocha."

The Western crop was formerly shipped down the River Sobat and River Nile to Khartoum and thence exported to Europe through Port Soudan. Merchants found, however, that they could obtain a good price in the local market at Khartoum and the Abyssinian coffee is now ousting Brazilian coffee. The Abyssinian bean seems to make a more oily coffee, which is preferred by the natives to the coffee made from the Brazilian bean.

G. BRYCE.

FUNGUS DISEASE OF COFFEE IN PORTO RICO.

For leaf rot *(Pellicularia koleroga)* there has been found no really satisfactory method of control. The benefit of repeated sprayings with Bordeaux mixture is lessened by the fact that the fungus is not all killed even by repeated sprayings, enough remaining to re-infect the trees after a time.

For a leaf spot *(Stilbella flavida)* Bordeaux mixture is really effective, and it may be recommended to prevent the disease from extending to healthy and productive plantings.

Cercospora spot of the berries, which causes the more badly affected berries to be pulped with difficulty, and also injures the grain to some extent, is to be prevented in its worst form by providing sufficient shade, which by rendering less harmful this and other sources of injury to the grain decidedly improves the quality of the output.

The root disease may be prevented from spreading by ditching, this being preceded by the removal and destruction of vegetable debris, diseased trees, and stumps. It is apparent that the addition of unslaked lime, sulphur, and some other substances to the soil prevents the growth of the fungus causing the disease.

Importance is to be placed on the use of preventive measures to keep the still healthy younger plantings in good condition rather than on attempts to exterminate the diseases among the older trees.—BULL. No. 17, PORTO RICO AGRIC. EXPT. STN.

COFFEE IN CEYLON.

There has been a larger demand for Robusta coffee seed than we have been able to meet.

The Robusta plot has been severely attacked with green scale *(Cocos viridis)*, but this pest has been kept well in check by spreading the fungus *Cephalosporium lecanii* by taking infected leaves and pinning them on to branches infected with the scale. *Hemileia vastatrix* also made its appearance, but does not seem to do much serious damage to Robusta, as it does to *Canephora*, Liberian, and Arabian coffees. Die-back of the branches *(Colletotrichum incarnatum*, Zimm.) is also present.

The small plot 140C, of Robusta, planted out in October, 1913, without shade, has made very slow growth, and has been severely attacked both by green scale and *Hemileia*. Half the plot has been sprayed and half unsprayed to watch the effects.

The plot of Liberian coffee, which was so badly infected with scale and leaf disease as to be a source of continual infection, has been uprooted and burnt and young Robusta plants planted out in its place under the shade of the old *Leucæna glauca* trees. The plants are thriving, and no disease has made its appearance.

The hybrid coffee round the show plots seems to have thrown off its diseases, partly no doubt due to the spraying and to the intensive cultivation given to it. The trees are bearing in consequence a heavy crop.

The Uganda coffee bushes have been attacked by the green scale, but having become self-infected with fungus *(Cephalosporium lecanii)* the scale has all been killed out. This is interesting, as it was supposed the fungus only thrived under shade and in a damp atmosphere, whereas these bushes have no shade whatever.—ANN. REPT. OF THE MANAGER, EXPT. STN., PERADENIYA, 1914.

RICE.

PADDY IN THE MANNAR DISTRICT.

The District of Mannar is interesting because it has not fallen into the severe decadence that its neighbouring districts—the Vanni districts have succumbed to.

"I think it is wonderful," wrote MR. BOAKE in 1888, "considering the excessive taxation in the earlier years of the century, the unhealthiness of the district, the frequency of cholera introduced from India, the defective means of irrigation, and the variableness of the rainfall, that the industry [paddy] has not altogether died out. Nothing could have withstood the oppression by man and the persecution by nature but the great love of the people for their land and the fertility of the soil."

On the other hand, it must be remembered that the district is in a very backward state due largely to the unhealthy climate and a small inconstant rainfall which has hitherto prevented the land from being more densely peopled. This is reflected in the character of the people who are not thrifty? The social economy of such a community is very simple. Farming is not looked upon so much to make profits as for the production of the necessaries of life enough merely to *maintain* a family in reasonable comfort. If, therefore, a man needs about 48 bushels of paddy for his own consumption he sows only that extent of land which on harvest will satisfy his needs.

In physical features the district is ideal for the development of a rich rice-tract. It consists of a level plain with a fertile soil intersected by rivers that slope gently east and west admirably adapted for canalization.

The cultivation of paddy is taken up under Giant's Tank and connected works. The houses of the villagers adjoin the paddy fields, some of them have small plots of garden produce or these may even be planted up with coconuts.

The tanks, seldom if ever, are more than half full; this necessitates a restriction of the area that can be cultivated during the dry season and results in grievances between those who can cultivate their lands and those who cannot.

At present, the villagers have to contribute in labour according to the extent of the land they own, but they prefer to commute their labour for a money payment. Wandering gangs of Indian coolies do all the earthwork in shaping, sloping and building the bunds. Sub-inspectors of Irrigation supervise this labour as well as other matters concerning irrigation. A scheme devised so as to secure an Agricultural training for these men should prove of great benefit to the cultivators.

The rainfall of the district is about 35 inches or under, mainly in the North-East monsoon, when about three-fourths of the total rain falls in the last three months of the year.

Agriculturally, the year is divided into two seasons:—

1. *Sirupokam.*—The dry hot season extending from June to September when a three-month paddy is raised.

2 *Kalapokam.*—This extends from October to May and a five-month crop is generally taken.

The raintall is insufficient to mature the paddy crop and irrigation is hence necessary to tide over the breaks in the monsoon.

Manvari fields or fields cultivated with rain-water only are seldom, if ever, met with.

There are two methods of cultivation depending to some extent on the nature of the soil.

1. PULUTHI CULTIVATION.

This is generally practised on sandy soils which are considered less fertile. Agricultural operations begin after April. Sheep, goats or cattle are folded on the land for about ten days, They graze on the stubble of the previous crops together with the grasses and weeds that generally over-run the fields. The land is ploughed twice with the ordinary indigenous wooden implement and once after every shower of rain. This type of cultivated fallow is kept on till September when at the sign of rain the seed is broadcasted on the land and the soil ploughed once. The seed rate is heavy being about 2¼ bushels to the acre.

In October which is a rainy month irrigation is rarely needed.

In November, irrigation is necessary about once in ten days.

From December to February the cultivators are compelled to become active. Irrigation is necessary about once every week; weeding is a very laborious operation and has been estimated to cost about Rs. 9 per acre. A notorious weed is a variety of *Panicum crus-galli* (*S. Wel-marukku ; T. Koli-chudan pullu*) which grows rapidly and tillers excessively choking out the paddy plants.

In March the land is gradually dried as the crop comes to ear and in the latter half of the month harvesting operations commence.

The variety of paddy preferred for this season is *Palasitheri.* It is a big-grained white variety and takes five months to mature. The yield is on an average 10 to 15 fold. This variety finds a better market in Jaffna than in Mannar. It commands an average price of Rs. 2 per bushel in Jaffna and Rs. 1/75 in Mannar. The trade is mostly in the hands of Moormen who contrive to secure a large portion of the crop by lending out money and seed paddy to the cultivators at high interest.

Other varieties grown are *Elankalayan, Motakaruppan and Panankalayan.* They all mature in about five months.

2. TWO CROPS A YEAR.

This type of cultivation is done on fertile clayey loams. The preparatory tillage for both the crops is always on land that has first been irrigated and the seed is thus broadcasted in the mud. The land is ploughed and puddled three times, levelled with a plank and the seed broadcasted at the rate of about 2¼ bushels per acre.

The significance of this is seen when we understand that the rains after sowing are so heavy as to spoil the germination of the seed, making it

necessary to sow two or three times over, thus involving extra expenditure as well as encroaching on the too limited growing season.

Since the floods in the Aruvi-ar come before the rains in Mannar, it is possible to utilise the water in the Giant's Tank and other minor tanks to irrigate the land and strengthen the seedlings before the disastrous rains come on. This method of cultivation is thus likely to supersede *puluthi* cultivation.

For the *Kalupokam* season, operations begin in November and the after-tillage is similar as described before. Manuring or the folding of cattle on the land are very seldom practised. It depends largely on the means of the cultivator.

For the *Sirupokam* season, the problem of manuring becomes acuter; April is generally a busy month as the paddy has to be carted, threshed and disposed of or stored. There is no time left to fold cattle on the land and it is only the well-to-do cultivators who can cart cattle manure on to their fields. Otherwise, unless time can be found to fold cattle or goats on the land, manuring is never practised.

Sowing operations begin in May after the land has been puddled as described above and the crop is harvested at the end of July.

The variety of paddy taken at this time is a coarse-grained red variety known as *Seenaddi;* it is a three-month paddy and at the time commands the best price in Mannar where it is preferred even to *Palasitheri.* The price in Mannar is about Rs. 2 per bushel when *Palasitheri* is sold for Rs. 1/75 per bushel.

Another variety, *Murugan*, gives a better yield but it needs one more irrigation and thus holds the ground for about a week or ten days longer.

The yields of these three-month varieties are about ten-fold when manured. This is rarely obtained and 5–7 fold may be said to be the average yield.

H. L. VAN BUUREN, JR.

STORING RICE IN JAPAN.

TO THE EDITOR OF THE TROPICAL AGRICULTURIST.

DEAR SIR,

In reply to MR. JAS. F. KEDDIE's enquiry on the subject in the TROPICAL AGRICULTURIST of May, 1915, allow us to state how the rice in husks are stored here in Japan.

We keep the rice packed in straw bags tied up with straw rope, in a well ventilated shed, and piled upon blocks so as to allow a current of air to pass through underneath. In this manner rice in husk keeps immune from insects and is prevented from getting mouldy. The tighter bound the better; if loosely bound climatic conditions may affect the contents.

Bamboo basket plastered with clay and cow dung as mentioned by him is, we think, liable to dampness. Tough paper lining would be a far better insulator against atmospheric influence.

The straw bags and rope one can easily make on the spot where rice is produced. Any further information can be obtained from us.

Yours faithfully,

The Yokohama Nursery Co., Ltd.,
S. IIDA,
Manager.

Yokohama, Japan,
July 10th, 1915.

PADDY CULTIVATION IN CEYLON.

There has been no striking extension in the cultivation of paddy, though official statistics indicate that the area is increasing.

Proposals made in various quarters to take up cultivation under the tanks and effect a settlement either of Sinhalese or Tamil labour have not materialized. At the suggestion, however, of the Ceylon Planters' Association, a few preliminary trials in growing Indian rice suitable for Tamil cooly labour were begun last maha season at Maha Iluppalama, Anuradhapura and Nalanda.

The term "cooly rice" as used in Ceylon is not very definite, since the rice that coolies consume in India is not what they usually get on Ceylon estates.

In a letter from the Deputy Director of Agriculture, Madras Presidency, that officer reports that no varieties of the names which are so familiar in the Island as cooly rice (soolai, kallunda, etc.), are known in Southern India, whence most of our estate labourers come. He adds: "I know what the labouring classes here eat, but what they get is more a matter of necessity than of taste. The Tanjore cooly, for instance, who gets grain wages, usually gets kuruvai or ottadam, both coarse varieties, which do not digest quickly, and are suited to hard manual labour and a bare living wage."

It would thus appear that the rice (imported from Bengal and elsewhere) which the Indian cooly is given here is one of the conditions of service in the Island which he duly appreciates and is probably attracted by.

If an approved syndicate of capitalists put forward a business proposition for the cultivation of paddy under tank irrigation, the easiest possible terms should, I think, be offered to open the way, if possible, for the colonization of the extensive areas under Giant's tank (with 20,000 acres irrigable), Kalawewa (17,000), Minneri (9,000), Nachchaduwa (6,968), etc.

The system of "transplanting" is slowly but steadily being taken up, and the practice of economy by this means as well as by thin broadcasting is calculated to effect an immense saving of seed.

In some parts of the Island as much as five bushels of seed are used per acre. The ordinary sowing is two bushels, and what reduction could advisedly be made on this latter rate is the subject of investigation. So far no definite conclusions have been reached, but the indications appear to be that sowings are much too heavy.

One of the chief reasons for thick sowing is no doubt that it is a means of suppressing weeds, which, especially in muddy fields, are difficult to deal with in the ordinary way.

The system of manuring paddy by means of a green crop raised on the field to be afterwards turned into the soil has been demonstrated in the different Provinces, and its economy and efficiency have appealed forcibly to the cultivator. The Government Agent, Sabaragamuwa, is encouraging the practice of green-crop manuring in the Ratnapura District, where the improvement of the fertility of rice fields is much to be desired.

Of introduced paddy muttusamba, Carolina and molagusamba are being cultivated regularly. The attention that has recently been directed to the subject of paddy cultivation, though not associated with any large practical scheme, has through the efforts of such agencies as the Agricultural Society and the Low-country Products Association, with the co-operation of individual landowners well known for their altruism, resulted in increased interest and greater faith in the possibilities of improving local methods of cultivation, so as to approximate our yields to those of other rice growing countries.—ANNUAL REPORT OF THE SUPERINTENDENT OF LOW-COUNTRY PRODUCTS AND SCHOOL GARDENS, CEYLON, 1914.

PADDY AT MAHA ILUPPALAMA.

The trials at Maha Iluppalama this year have been conducted on the same lines as last year, namely, to compare the results obtained from the high and low rates of sowing 3- and 4-month paddy. In the maha season an experiment was put in hand with a 3-month paddy. The variety used was bala-wi, and the trial carried out on 1-acre plots.

Plot 1 was sown broadcast with 2 bushels of seed, plot 2 with $1\frac{1}{2}$ bushels, plot 3 with $2\frac{1}{2}$ bushels, and plot 4 with 1 bushel. The results were rendered valueless owing to the depredations of pigs. The total yield from the four plots was 80 bushels of paddy.

In the yala season another trial was carried out, also on 1-acre plots, in this case with a 4-month paddy. The variety used was sudu-wi. The results were :—1 bushel gave $27\frac{3}{4}$ bushels, $\frac{1}{2}$ bushel gave 42 bushels, and $\frac{1}{4}$ bushel gave $54\frac{1}{2}$ bushels. It is noteworthy that in all our trials the lowest rate of sowing has almost invariably given the best results.

With the opening of the new Experiment Station at Anuradhapura, work at Maha Iluppalama Experiment Station is entirely devoted to the cultivation of coconuts and paddy.—ANNUAL REPORT OF THE MANAGER, DRY ZONE EXPERIMENT STATION, 1914.

COTTON.

COTTON IN BRITISH COLONIES.

Cotton growing in British Uganda continues to make progress. In 1914, ginned cotton exports from this colony amounted in value to £45,231. The Uganda cotton industry would become much more important were it not for the difficulties of transportation. The whole of the main crop for 1914 was of the Allen's Long Staple variety. Cotton growing in the British East Africa Protectorate is not profitable, except along the banks of the Tana and Juba rivers where irrigation is possible. In the Lake District of the Nyanza Province the climate and soil are quite favourable to cotton growing and it will doubtless become quite an important industry.

In Nyasaland the area under cotton cultivation by European planters amounted in 1914 to 25,097 acres, of which 160 acres were planted in Egyptian cotton and the remainder in the Nyasaland Upland variety. The total exports for 1914 amounted to 6,003 bales of 400 pounds, as compared with 8,093 bales exported during the previous year, this decrease being due to the failure of the crop in some districts. During the same year native plantations produced 1,811 bales of 400 pounds as against 1,126 bales in 1912-13.

Jamaica's 1914 cotton crop was a failure, owing to abnormal climatic conditions. In 1913, the crop was valued at £4,000 and consisted of the Sea Island variety, being grown mostly by small planters in Vere. Following the failure of the 1914 crop, Jamaica planters are seeking for a more hardy variety of cotton for general planting in the Island. A perennial tree cotton has been introduced from Cauto in Cuba and has given good results. In the drier districts of the Island this Cauto cotton is expected to become the basis of a reliable cotton growing industry. Experiments have also been made with the Sakelarides and other Egyptian varieties of cotton. The Cauton cotton tree grows wild in South-eastern Cuba.

In Fiji cotton growing was started in 1906, when the Lautoka Experimental Station planted seed of two kinds of Sea Island, one of which had been obtained from Barbados, the other from St. Kitts. Good results have been obtained, the yield of lint ranging from 252 to 311 pounds per acre. The cotton produced in Fiji is all medium staple, and therefore, more readily saleable than cottons of the finer staples, though having larger yields.—INDIA RUBBER WORLD.

COTTON IN THE BRITISH EMPIRE.

The following approximate estimate of cotton grown in new fields in the British Empire is taken from the Tenth Annual Report of the British Cotton Growing Association:—

BALES OF 400 LBS.

	1908	1909	1910	1911	1912	1913	1914
Gold Coast ...	200	200	100	100	120	100	100
Lagos ...	5500	12100	5900	5800	8900	14000	13600
Southern Nigeria ...	200	300	300	300	270	200	150
Northern Nigeria ...	500	400	400	600	2600	2000	1000
West Africa ...	6400	13000	6700	6800	11890	16300	14850
Uganda ...	4000	5100	12000	20000	29000	26000	4200
British East Africa ...	300	300	400	500	900	1000	500
Nyasaland and Rhodesia ...	2100	2800	3400	5300	7200	7500	8000
East Africa ...	6400	8200	15800	25800	37100	34500	50500
Sudan ...	?	?	15000	21000	15000	14000	20000
West Indies ...	7000	6400	5500	6500	6500	7000	6000
Sundries	500	500	500	700	1000	1000	1000
Total ...	20300	28100	43500	60800	71490	72800	92350
Approximate value ...	£330,000	£450,000	£696,000	£840,000	£952,000	£1,074,100	£1,194,750

MANIOC AND GROUNDNUT MEAL.

The addition of 4 lb. of good quality maize gluten feed to the basal ration of dairy cows was compared with 4 lb. of a mixture of manioc meal and groundnut meal in the proportion of 3 : 2. This mixture was found to be at least equal to the maize gluten feed, and to result in a gain of 3*s.* 4*d.* per 220 lb. of concentrated food fed owing to the cheaper prices of groundnut meal and manioc meal as compared with maize gluten feed.—JOURNAL OF THE BOARD OF AGRICULTURE.

FRUIT.

PLANTAIN DISEASE IN CEYLON.

The root disease of plantains recorded in the last report is still under investigation. A *Fusarium* has been found in the diseased plants, but it has not yet been proved that this is the cause. It has been demonstrated that the disease spreads rapidly to neighbouring plants. A leaflet on this disease was issued by the Agricultural Society.

Another disease of plantains which occurred on the Experiment Station, Gangaruwa, was examined by the Assistant Botanist and Mycologist. This was primarily a leaf disease, the attack beginning at the margin of the leaf and spreading down the petiole. The older leaves were the first attacked, and from these the fungus spread to the younger. The disease was checked by cutting off and burning the diseased leaves. The fungus found was a *Fusarium*.—REPT. OF THE BOTANIST AND MYCOLOGIST, CEYLON, 1914.

PLANTAIN DISEASE IN INDIA.

JEHANGIR FARDUNJI DASTUR.

Since May, 1914, a disease of bananas, resembling in some external symptoms the Panama disease, has been under observation at Pusa. The variety that has been found to be the most attacked is the *Kabuli* or *Bengali; Kanthali*, *Chini Champa*, and *Martban* are however not immune.

The diseased plants, from a distance, look as if they were suffering from drought or bad cultivation. The lower leaves begin to turn yellow, generally from the margin inwards and ultimately become brown and shrivelled up, but the blades do not necessarily break down at the base of the stalk, and gradually this process moves up the trunk involving at times all the leaves. These symptoms are not always found whenever the disease is present, at least in its early stages sometimes the blade remains green long after the leaf sheath is attacked, and at times it turns brown without first turning yellow. The leaf sheaths lose their healthy colour, become soft and watery and the trunk splits lengthwise. In some cases the diseased leaf sheaths get separated from the trunk, especially at the base of the crown; in these cases the stalk of the leaf blade frequently breaks down. The outermost leaf sheaths of a healthy trunk are generally without leaf blades, the blades having been either removed or having withered away; the dried tops of these leaf sheaths seems to be a suitable breeding ground for this disease as the infection has often been first found at these places, the rot of the leaf sheath commencing from the top downwards. The inner leaf sheaths may become infected from the outer leaf sheaths. The newly diseased inner leaf sheaths show the point of infection by the presence of discoloured red or brown spots, which have a dark centre surrounded by a diffused lighter area. As these spots grow, the rotting of the leaf sheaths

begins and consequently the leaf blades turn first yellow, then brown and ultimately wither. That the inner leaf sheath may be directly infected by the diseased outer leaf sheath is probable from the presence of fructifying hyphæ on the inside epidermis of the outer sheath. These hyphæ bear *Cephalosporium* spores ; in cultures they give *Fusarium* spores as well and this latter kind of spores is also at times found on the leaf sheath. Cultures from pieces of diseased parts, sterilised by flaming after soaking in rectified spirit, have given a *Fusarium* with a *Cephalosporium* stage. Sections from the diseased areas have shown the fungus not only in the wood cells, as found by ASHBY* and DROST† in case of the Panama disease, but also in the cortex and *Cephalosporium* spores borne on short conidia have been observed in some cells. The walls of the cells of the infected tissues usually take on a brown yellow, honey or vine coloured discolouration and the lumen of the cell is sometimes filled with an insoluble gum of the same colour.

As a rule the trunk is first attacked, the disease proceeds inwards and may ultimately kill the plant but cases have been found in which the attack commences from the heart leaf. If the attack is not severe the growth of the plant is not checked. When, however, the heart leaf comes out from the centre of the crown some portion of its still folded leaf blade is found to be damaged. The diseased portions are brown or black in colour, they are unable to unfold themselves along with the healthy parts of the leaf blade, and consequently get torn to pieces. The area surrounding the diseased parts is chlorotic and almost white. The leaf bud enclosed by the heart leaf may completely escape infection. In other cases the attacked heart leaf is at times observed to come out of the green and healthy crown but it is twisted, crumpled and brown and its growth is completely checked ; white and pink ascervuli are found on it. These are the beds of *Cephalosporium* and *Fusarium* spores. The leaf buds enclosed within this heart leaf may also be attacked and their growth checked ; but, under favourable circumstances, the disease does not make headway and the growing point continues to grow and after a long time a new healthy leaf is observed arising from the crown.

In some cases the growth of the plant is completely checked. Except for the absence of the central unopened leaf there is nothing unusual about the appearance of the plant, the crown leaves are green and healthy and so is the trunk. When such a plant is split open, it is found to be rotten at the core with the heart leaf a black, putrid, crumpled mass. The surrounding sheaths are also attacked. The rotting has invariably been found to commence from the apex downwards, the infected portion being black and rotten. The soft tissues are destroyed leaving behind shreds of fibres; in advanced cases the rotten tissues give out a characteristic foul smell. From such an attack the plant, of itself, has not been found to recover ; but if the trunk be cut as far back as the healthy part the growing point puts forth new leaves. Of course the vitality of the plant is very poor and consequently it produces very poor fruits.

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* ASHBY, S. F. Banana Diseases in Jamaica. BULL. DEPT. AGRI., JAMAICA, N. S. II., No. 6, 1913.

† DROST, A. W. The Surinam Panama Disease of the Gros Michel Banana. BULL. DEPT., AGRI,, JAMAICA, N. S. II., No. 6, 1913.

In the Panama disease which has been found by DROST* and ASHBY† to be due to a *Fusarium* with a *Cephalosporium* stage, and in the Chinsurah disease reported by BASU‡ to be due to the same genus, the attack in all cases is sudden and rapid, so that once the field is diseased it is soon completely destroyed. This is not the case with the disease at Pusa. The progress of the disease is slow and it does not always prove fatal. When a leaf is attacked the disease has been found to remain confined to some portion of the leaf and not to envelop the whole leaf ; in cases where the trunk is attacked, the disease may spread on to the whole trunk and ultimately may kill the plant but death occurs long after the infection has first been observed. Sometimes the disease is found to have ceased growing after having attacked almost the whole of the trunk. In this case the outer leaf sheaths are dry and leathery, their softer tissues being almost destroyed and fibrous tissues in shreds. The outer leaves are completely brown and leathery to touch. That the plant is not killed is evident from the presence of one or two central new green leaves or from the presence of a fruiting bunch, if the plant be bearing. These fruits ripen normally but they are smaller in size and fewer in number. This condition is more particularly applicable to the *Bengali* or *Kabuli* variety. When the top of the trunk is attacked and the crown of leaves is destroyed the heart leaf in some cases instead of coming out from the centre of the crown breaks through the healthy part of the split trunk and comes out from its side. The diseased parts of the plant wither and drop off ; it continues to grow but remains a weakling and bears a fruit bunch with very few fingers. Not only has the heart leaf been found to emerge from the side of the trunk but the flowering stalk as well. The progress of the disease can be checked if the infected leaf sheath or leaf be removed in the early stage of attack.

This disease does most damage when the stalk of the fruit bunch is infected, and it is remarkable that the attack is generally found on the upper surface of the stalk. If the stalk gets diseased in the early stage of its development the whole bunch is destroyed before the fruits ripen ; but they ripen normally if the attack is late. The diseased part is black, surrounded by a diffused purplish area. As this attack progresses the diseased part becomes soft and sunken, the cellulose tissues being destroyed, leaving behind strands of fibrous tissues. From the stalk the disease proceeds to the fingers. If the stalk gets attacked from within the trunk, it breaks at this point on account of the weight of the fruits even though the attack be not severe. Only in one or two cases has the attack been found to proceed from the tip of the finger inwards. The diseased tips are black and wrinkled and show a pinched-in appearance. Hyphæ bearing *Cephalosporium* spores have been found inside of these tips; in cultures they have produced the *Fusarium* stage.

Two important and characteristic symptoms of the Panama disease and of the disease at Chinsurah, which appears to be identical with the former, have not been found in the disease at Pusa. There is a sudden appearance of imperfectly developed leaves in the former. Such leaves have not been

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* DROST, A. W. (Ibid).

† ASHBY, S. F. (Ibid).

‡ BASU, S. K, Report on the Banana Disease in Chinsurah. QUAT. JOURN. DEPT. AGRI., BENGAL, IV., No. 4. 1911.

found till now on the affected plants at Pusa. Again at all stages of the growth, if a head of a "sick" tree be cut it will be found to be diseased. In nature the head or the "yam" has not been found to be attacked at Pusa except in rare cases when the whole of the leaf sheath is completely rotten and the disease then travels from the base of the leaf sheath to the head. Here the disease has always been found to travel from the top downwards and not from the yam upwards. Whether this disease is present in many other places is not known but it was found during a short visit to Muradabad last year.

Inoculation experiments with pure cultures taken from diseased parts have given positive results. Suckers of *Kabuli* or *Bengali* variety were inoculated with pure cultures of the fungus. The outer sheath was inoculated through a wound made by a sterilized knife. The outer leaf sheath of another sucker was inoculated at the point where the blade had withered and fallen off. The effects of the inoculation were seen within a week. The inoculated leaf sheath began to rot; the rot spread downwards and inwards and the heart leaf broke through the side of the trunk. From the rotting part *Fusarium* hyphæ and spores were found. In another case the tip of the heart leaf was nipped and then inoculated. When the heart leaf grew out of the protecting petiole it was only partly able to unfold itself. The portion where the inoculation had taken effect was black and shrivelled up, and remained unopened.

Inoculations by injecting with a hypodermal syringe *Fusarium* spores suspended in distilled water have been successful; in one case the heart leaf was hidden in the centre of the trunk when the injection was made, so it was got at by introducing the needle through the base of the outer leaf stalks. When the heart leaf opened, the midrib and some parts of the blade were found to be injected. That the inoculation of the midrib was successful was evident from the presence of purplish longitudinal streaks originating from the injected portion. This discolouration extended to the whole circumference of the midrib for a couple of inches below and above the place of inoculation. About a fortnight after the inoculation the midrib was cut through this discoloured portion and the tissues were found to be rotting. Microscopic examination showed the presence of *Fusarium* hyphæ and discoloured cells filled with some insoluble gum, as in the case of naturally infected tissues. The margins of the puncture made by the needle on the blade were brown, and surrounded by a chlorotic area when the leaf had just opened. Sections made from these portions showed the presence of *Fusarium* hyphæ and purplish or brown coloured gum in cells.

The underground stem has also been successfully inoculated. A small piece was removed from the head underground; mycelium from a pure culture was introduced in the cavity and the piece replaced in position. After a month the inoculated plants were dug out and the infection was found in all stages of progress. The badly infected area was a brown putrid mass; the newly infected tissues at a distance from the seat of infection were firmer and wine red in colour. In cases where the infection had not advanced much the tissues near the point of inoculation were brown but firm, and the presence of the infection beyond this browning was noticeable in a section across the bulb as black or brown dots corresponding to the position of the vascular strands; in a longitudinal section these dots are seen as streaks criss-crossing one another. Unlike the Panama disease, the hyphæ have not been found confined to the vascular tissues.

From the preliminary study of the pure cultures obtained from the diseased parts it seems that this *Fusarium* with a *Cephalosporium* stage differs from that studied by ASHBY in pure cultures as the cause of the Panama disease.—AGRIC. JOURN. OF INDIA.

CITRUS FERTILISATION EXPERIMENTS.

The response to fertilisation was very prompt and the effect pronounced on both trees and quantity of fruit produced.

In each plat given but two elements the leaves were smaller and lighter in colour than in those given a complete fertiliser. This difference in colour was not great in the grove at Bayamon, and was most pronounced in other groves during periods of drought. In the grove at Pueblo Viejo the colour was poorest in the plat given no phosphoric acid, and in the grove at Manati, where no nitrogen was given.

The growth in the check plats was so slow and unsatisfactory that all except one were discontinued before the conclusion of the experiments Where but two elements were given the growth of both trunk and top was much slower than where a complete fertiliser was given.

The appearance and growth of the trees in plats given a complete fertiliser were practically the same except that in a plat given nitrogen in the form of dried blood they were not as thrifty.

The weight of fruit per tree harvested from the check trees was but 27 per cent. of that from the trees given a complete fertiliser.

Where records of yields were made, the crop from plats given a complete fertiliser was decidedly greater than where but two elements were applied. In one grove the gain in yield by plats given three elements over those given two was 80 per cent., and in the other 44 per cent.

When but two elements were applied, the plats given no nitrogen gave the poorest yield. The plats given no potash bore more than the plats given no phosphoric acid or those given no nitrogen.

The average weight of the fruit per hundred was heavier in the plats given no nitrogen than in those where phosphoric acid or potash was omitted.

Where potash was applied in the form of muriate, the crop was heavier in one orchard and slightly lighter in the other than where applied in the form of sulphate. These differences are too small to indicate that for the quantity of fruit production one form of potash is superior to the other. No differences were noted between these plats regarding quality, flavour, or colour of the fruit.

In the grove at Pueblo Viejo, where the element nitrogen was applied in the form of nitrate of soda, the yield was but 83·7 per cent. of that where an equal amount of nitrogen was given in the form of sulphate of ammonia. At Bayamon there was practically no difference resulting from the two treatments.

The yield from the plat given nitrogen in the form of dried blood was but 75 per cent. of that where sulphate of ammonia was given.

No marked difference in flavour of fruit was observed resulting from the application of different fertilisers.

Differences in time of ripening of the fruit in fertilised plats, resulting from different fertilisers applied, were not apparent. The fruit ripened earlier in the check plat than in the fertilised plats.—BULL. No. 18, PORTO RICC AGRIC. EXPT. STN.

SUGAR CANE GROWING IN CEYLON.

N. WICKRAMARATNE

[*Paper read before the Ceylon Agricultural Society, August 31, 1915.*]

Among the tropical food products that have been seriously affected since the beginning of the present war, is sugar. We in Ceylon, who depend on foreign supply for our requirements, have also been affected by the changes that have taken place, and, as a result, have to pay nearly double the price paid before the war.

Our consumption is constantly increasing since our village population, who hitherto used jaggery, are now employing sugar more and more.

Those who have an agricultural interest in the island have naturally raised the question whether Ceylon cannot produce sugar sufficient at least to supply the demand for the lower grades which are used by the masses.

Sugar cane is found growing in all parts of the island, but it is only in the Galle District that any sugar is manufactured. The fact that cane grows well and that sugar is produced, albeit on a small scale, at a profit, gives ground for belief that it ought to be possible to meet the bulk of our own requirements provided that both cultivation and manufacture are properly conducted.

Sugar growing, it is true, was abandoned by European capitalists as non-remunerative ; but this was the case also with the citronella industry, which has survived in the hands of the local agriculturists. It is a coincidence that both the industries are confined to the Southern Province.

There are seven sugar cane mills (worked by bullock power) in the villages in the valley of the Ginganga River, but all these mills are not at work. The Blue Book gives as 2 in 1912 and 5 in 1913, referring evidently to the number of the working mills.

FERGUSON's Directory gives the area under sugar cane in the island as 20,000 acres, which can eventually be extended to 40,000 acres. Omitting, however, the area under sugar cane grown for the purpose of chewing, the total grown for sugar manufacture is probably not more than 400 acres.

MESSRS. WINTERS of Baddegama were the last European capitalists to grow sugar on a commercial scale, since when the industry is in the hands of Sinhalese planters.

Among the latter the late MUDALIYAR D. E. A. JAYASINHA of Nagoda was the pioneer. He had sugar mills driven by steam power and made the business pay, but with his death the enterprise waned.

In 1906, I made a report on this subject to the Ceylon Agricultural Society from which the following facts are culled :—

Baddegama, Nagoda, Mapalagama and other villages situated on the banks of the Ginganga are the places where sugar cane is grown. The industry was once the mainstay of the people where every patch of "owiti"

land was under this crop. The village cultivator delivers the produce of his field to the nearest mill where it is turned into sugar, a third being appropriated by the mill owner for the cost of manufacture. The first crop which is reaped a little over a year from planting was reckoned to return a net profit of at least Rs. 100 per acre. One or two later crops, raised from ratoons, are generally counted upon, but the amount of produce from such crops depends on the fertility of the soil and subsequent careful cultivation. There is a ready market for the crude sugar made on these mills, but cultivation for sugar is for some reason or other declining.

The cultivation of other paying crops, the inability to compete with foreign sugar and the absence of any encouragement to effect improvement in cultivation and manufacture, are probably some of the causes for this unsatisfactory state of affairs.

But with the present rise in price and with encouragement from official sources there is no reason why the industry should once again be revived, and with advantage both to the grower and consumer.

Ceylon imports sugar from Hong-Kong, Java, the Straits Settlements, Mauritius, India and other countries. Even Austria and Belgium used to export sugar to this Island.

The following figures taken from the Blue Book show the amount of money annually going out of the Island for refined and unrefined sugar.

Value of imports in 1911-12	...	Rs. 4,135,718·00
,, ,, 1913	...	Rs. 5,429,070·00

The quantity imported in 1911-12 of refined sugar was 365,421 cwt., unrefined 8,474 cwt. In 1913, refined sugar 527,378 cwt., unrefined 10,882 cwt.

Taking a ton of sugar as the lowest yield per acre (though 2 and even 3 tons are possible) and accepting FERGUSON's estimated area of 20,000 acres, an output of not less than 20,000 tons of sugar can be expected at present, if all the cane produced is utilized for manufacture. Taking the price per cwt. at Rs. 10, the total value of the produce will be four million rupees. This will be doubled if the whole area of 40,000 acres is brought under cultivation.

My object in this paper is to invite the attention of local agriculturists to the possibility of making sugar growing a village industry by adopting co-operative methods. There is already in existence the system of co-operation between the grower and the mill owner, but this is more to the benefit of the latter.

In India, especially in Mysore, the co-operative measures have given an impetus to the sugar industry. There we find co-operative societies working under special by-laws for increasing the output of the locally made sugar.

The Government assists in purchasing machinery, selecting sites and erecting plants; training men and supervising the work as well as giving expert advice, and above all lending money to be repaid by small instalments.

We, too, now have similar advantages (which we had not before) under our co-operative movement which give financial assistance to such industries, and it is for the people to avail themselves of these benefits and utilize them for the common good of their fellow villagers.

There are sugar mills worked by hand power or bullock power suitable for village use, and others driven by steam power suitable for big capitalists. A small bullock power mill can be had from Rs. 100 upwards. A mill of this type will be sufficient for a village growing 25 to 500 acres of cane. The Director of Agriculture, Mysore, recommends the "Nahan" mill which produces a higher percentage of juice than other mills suitable for village use. There is yet another popular mill called the "Hathi," also worked by bullock power, the cost of which is under Rs. 200.

The following are some notes on the cultivation of the sugar cane as practised in the Galle District.

VARIETIES.

Both the Mauritius red and striped canes are grown.

LAND.

Flat stretches of land in the valley of the river commonly known as "owiti" or "talawa" are selected for sugar cane. These lands consist of alluvial soil of a brownish colour and is of a fine texture.

PREPARATION OF THE LAND.

Careful attention is given to clearing, drainage, fencing and tilling. The scrub is cut and removed or burnt. A trench of 2 to 3 feet deep and 1 to 1½ feet wide is opened all around the land, and the earth removed from it is heaped on the inner edge of the land to form an embankment on which a fence, generally a live fence, is set up. This is intended as a protection against cattle and floods.

Ridges are made 4 feet broad at the base and about 2 feet high each, with furrows between them each 1 foot wide. These may be of any length.

PLANTING.

The soil in the furrow is dug out or loosened and two rows of cane tops are planted in the furrow bordering the ridges on either side, and afterwards covered with half an inch of soil cut from the edge of the ridge.

Cane tops are placed in such a way that the heads of the tops of one row face one direction and the other row the opposite direction. These tops are cut about 2 feet long with two or three nodes.

IRRIGATION.

No irrigation is done as rain is expected to supply all the necessary water Planting takes place during the monsoon.

WEEDING.

Two months after planting the first weeding takes place ; the weeds are collected and put on the ridges to add humus to the soil. A second weeding is given two months after the first.

AFTER CULTIVATION.

A month afer the second weeding or in the first month of planting the earth is cut from the ridges and thrown into the furrows so as to bring the furrows and the ridges to the same level. Six weeks after this when the canes have formed a few nodes, the withered leaves of the cane tops are removed and the earth from the sides of the rows is cut and thrown into the rows converting the original furrows into ridges, and the ridges into furrows. This is repeated every three months.

HARVESTING.

Sixteen or eighteen months after planting the cane is harvested. The tops, about 2 feet long, are first cut off to be subsequently used for planting. Heavy sharp knives are employed for cutting the canes so as to give a clean cut and ensure the growth of both tops and ratoons.

The canes are cleaned of trash and roots and are removed to the factory for milling.

RATOONS.

The canes growing from ratoons are treated in the same way. In about 12 or 14 months the ratoon crop is ready for harvesting. Two ratoon crops can be gathered from some canes.

ROTATION OF CROPS.

Sweet potatoes, dry grain and pulses are grown by rotation in sugar-cane lands.

LABOUR.

In the preparation of land, fencing, drainage, etc., men are employed, and in weeding and other work, women and children.

EXPENDITURE AND INCOME FOR AN ACRE.

The following figures show the average expenditure in growing an acre of sugar cane and the income to be expected :—

EXPENDITURE

For preparation of land, trenching, drainage and planting ...	Rs. 16·00
Fencing	,, 15·00
6,000 tops at Rs. 3·00 per 1000	,, 18·00
For weeding and after cultivation	,, 20·00
Harvesting	,, 4·00
	73·00

INCOME.

1 ton or 20 cwt. of sugar at Rs. 10·00 per cwt. ...	Rs. 200·00
75 gallons molasses at 0·36 cts. per gallon	,, 27·00
8,000 cane tops at Rs. 3·00 per 1000	,, 24·00
	251·00

The net profit is : Rs. 178·00 minus milling expenses. In the case of those who have no mills, one-third of the produce (sugar and molasses) is given to the mill owner. Taking the cost of milling as Rs. 78·00, there is still left a net profit of Rs. 100·00 to the grower.

A ratoon crop gives us nearly the same return, while the expenditure on cultivation is greatly reduced.

No fertilizer is used except the cattle manure when available. Recently MR. M. A. JAYASINHA of Nagoda began some manuring improvements with common fertilizers.

The Ceylon Agricultural Society has imported a variety of canes known as B 208, which is said to yield a higher percentage of saccharine matter. Cuttings of these are being distributed to various centres.

SOILS AND MANURES.

PRODUCTION AND QUALITY OF SULPHATE OF AMMONIA.

The report of the Chief Inspector of Alkali Works for 1914 (H. C. 253,1915) shows that there were 624 works or separate processes for the manufacture of sulphate and muriate of ammonia in England and Wales in 1914, as compared with 595 in 1913, and 581 in 1912, the number having steadily increased from 449 in 1904. In Scotland the number of such works was 111. There were also 56 gas liquor works in England and Wales, and 8 in Scotland.

The quantity of sulphate of ammonia produced in the United Kingdom in 1914 is shown in the following table :—

Source.	1914.	1913.	1912.
	Tons.	Tons.	Tons.
Gas works	175,930	182,180	172,094
Iron works	16,008	19,956	17,026
Shale works	62,749	63,061	62,207
Coke oven works	137,430	133,816	104,932
Producer-gas and carbonising works (bone and coal)	34,295	33,605	32,049
Total ...	426,412	432,618	388,308

The disturbing influence of the war affected the production of most of these different groups of works in 1914.

The standard quality of British sulphate of ammonia has been the subject of discussion, some of the sulphate produced in this country prior to the war being said by foreign consumers to compare unfavourably, to a marked degree, with the product received from Germany. The Sulphate of Ammonia Association has, it is stated, issued directions as to the conditions best calculated to ensure a satisfactory product, but there is wide room for enquiry and research on the question of the manufacture of sulphate of ammonia with the object of getting the best product at low costs.

The question of efficient production is one which is likely to become more prominent as advance is made in the domain of synthetic nitrogenous fertiliser products with attendant reduced costs, increased production, and more severe competition; and centralised effort is recommended as offering the most hopeful expectations and most general advantage.

The exports of sulphate of ammonia in 1914 amounted to 314,000 tons as compared with an estimated home consumption (for all purposes, including manure manufacture) of 106,000 tons. The corresponding figures for 1913 were 325,000 tons and 97,000 tons respectively.

In the table below are shown the imports of the materials used in the fertiliser trade, the principal being mineral phosphates. A proportion of the nitrate of soda imported is used in the manufacture of sulphuric and nitric acids.

———	1914.	1913.	1912.
	Tons.	Tons.	Tons.
Guano	39,285	25,548	14,115
Mineral phosphates	555,605	539,016	520,270
Nitrate of soda	171,910	140,926	123,580

The number of chemical manure works under inspection in 1914 was 183 as compared with 217 in 1901.—JOURNAL OF THE BD. OF AGRIC.

INFLUENCE OF WEATHER ON SOILS.

The fourteenth "Masters" lecture was given by DR. E. J. RUSSELL, of the Rothamsted Experimental Station, on Tuesday last, at the Royal Horticultural Society's Hall, and dealt with the influence of weather and other natural conditions on the soil changes that had been discussed in the previous lecture. It had been shown that the decomposition of the residue of plant materials in the soil is of fundamental inportance in soil fertility, determining on the one hand the production of necessary plant nutriments and on the other the extent of accumulation of organic material in the soil, which, in turn, determines many of the soil properties. Three methods are adopted in studying this decomposition and in finding how it is affected by changes in conditions such as commonly occur in nature: measurements are taken of the rate at which oxygen is absorbed or carbon dioxide is given off by the soil; of the rate of ammonia or nitrate formations in the soil; and estimates are made of the changes in numbers of bacteria in the soil.

The first two can be determined as accurately as is desired, but the accurate estimation of bacterial numbers is not yet possible, and the values are comparative only; nevertheless, they are of considerable value for this work.

It may be taken as a general rule that the soil organisms, being living creatures, are dependent on suitable temperatures and water supply, that they must have food and sources of energy to enable them not to live only, but also to carry on those reactions which involve the accumulation of energy, or, in other words, resemble rolling a ball up a hill. These are general requirements that can safely be predicted of any living organism. In addition there is the special requirement that has been discovered by experiment: the need for calcium carbonate, without which many soil organisms will not act efficiently.

In dealing with soil, however, it is commonly the unexpected that happens, and experimental confirmation is required at every stage. Thus the effect of increases in temperature on the bacterial numbers is quite different from what might be expected; instead of rising, the numbers remain fairly constant up to about 80 degrees Fahr., and then they begin to fall. In like manner increases in water content of the soil do not lead to regular increases in bacterial numbers; there is a rise at first, but it is not sustained. So, in natural conditions, the numbers of bacteria do not show the expected fluctuations in the rise in temperature or moisture content. The discrepancy has been traced to the circumstance that the soil population is complex and is not formed of bacteria only. The figures do not give the effect on the whole soil population, but only on part of it, and they afford further evidence of the conclusion to which other experiments lead, namely, that the soil bacteria are subject to the operation of some limiting factor distinct from temperature and moisture content and food supply. There is reason to suppose that this limiting factor is to be found in the action of some of the less resistant and larger forms, such as protozoa, which keep down the numbers of the bacteria. This hypothesis explains all the facts that have yet been ascertained, but so many protozoa have been discovered in the soil that it is difficult to pick out the exact offenders and render the hypothesis more precise from the purely zoological standpoint.

The rate at which plant residues are decomposed and plant food is produced in the soil is, as we have just seen, indicated by the amount of carbon dioxide formed. The amount is found to follow the soil temperature during the winter months, but not during summer; indeed, during hot, dry weather the amount is distinctly low. Nor has the amount of carbon dioxide any very close connection with the moisture content; it depends more upon the rainfall.

Thus it appears that the rain does something more than add water to the soil, and an interesting problem is reopened which has, in the past, occupied a great amount of attention from agricultural chemists. From time immemorial practical men have felt that rain had a fertilising effect. Mediæval writers attributed it to some aerial spirit of celestial nitre washed down. LIEBIG, more precise, put it down to ammonia. As a result of LIEBIG'S support a vast number of analyses have been made of rain from all parts of the world, but all agree in showing that there is not enough ammonia present to make any practical difference.

The explanation offered is very simple. Air readily penetrates into a well-cultivated soil so that the soil atmosphere is not unlike our own. But the air dissolved in the soil water is something quite different; it is chronically short of oxygen, so that the plant roots and micro-organisms immersed in it could probably always do with more. Now rain is a saturated solution of oxygen, and when it falls on the soil it not only supplies the needful water, but also renews the stock of dissolved oxygen, and thus gives the micro-organisms and the plant roots a new lease of activity.

But the soil is not governed solely by the conditions that happen to obtain at the time being, it is profoundly influenced by those that have passed; indeed, one might go so far as to say that its properties are determined largely by its history. The shape, the size, and to a large extent, the composition, of the mineral particles are the result of forces that

caused the fragments of rock to chip off long ages ago, and have governed their wanderings ever since. The nature of the organic matter depends on the past vegetation which, in turn, depends on the climate; the micro-organic population is determined by the same cause. The soil as we see it to-day is the result of changes long since past as well as those still proceeding. In short, the soil is the embodiment of its history, and can only be read aright in the light of its history.

This is equally true of the minor events. Changes in conditions do not cease to be effective as soon as the old conditions are restored; they leave their mark which may persist for a long time. Very unexpected effects are sometimes produced. Experiments at Rothamsted and elsewhere have brought out the apparent paradox that conditions harmful to life lead to greater activity of micro-organisms as soon as they have passed, while conditions favourable to life finally cause decreased activity.

Thus, if a soil is dried for a long time and then remoistened or frozen very hard and then allowed to warm up, or heated, or treated with mild antiseptics—all processes harmful to life—it becomes a better medium for the growth of plants and of bacteria; the production of nitrate is increased, and the supply of phosphate becomes more available.

Again, whenever a soil is well supplied with organic matter, with moisture, and kept well warmed, the bacterial numbers do not keep as high as might be expected ; on the contrary they tend to come down. After a time these soils do not produce their full effect, and they are said to become "sick." Instances occur in commercial glasshouses which are kept at high temperatures where the soil, after a season's use, becomes unsuitable, and is, therefore, thrown out, all its valuable manurial residues being sacrificed.

"Sick" soils have been examined in some detail and the trouble was traced to at least two causes : an accumulation of disease organisms, and also an exaggerated activity of the factor limiting bacterial activity in ordinary soils.

These observations afford further evidence of competition among the soil organisms and indicate that some of the groups, and especially those which are fairly readily killed, are detrimental to the useful soil bacteria.

The effects of season and climate on the production of nitrate in the soil were discussed. It is notoriously difficult to generalise about seasonal effects, but, as a rule, the activity of micro-organisms is greatest in late spring and in autumn and lowest in winter and in dry summers.

The winter minimum is easily intelligible: the low temperature limits the activities of the organisms: in dry summer weather the moisture supply may be insufficient.

The spring maximum is the most interesting. It begins to show itself when the soil is drying after the cold and wetness of the winter, and when the sunny days first cause the temperature to rise. But it is the rain coming after warmth that causes the rush of life. Three factors seem to be involved. During winter the cold and the general unfavourable conditions have had their partially sterilizing effect on the soil population, and also have resulted in a certain amount of disintegration of the soil organic matter. Everything is, therefore, ready for a great outburst of activity. A start is made as soon as the soil begins to dry and to become warm, but the dryness that favoured

the warmth checks further development. Finally, all obstacles vanish when the warm rain comes, renewing the supply of water and the atmosphere containing the dissolved oxygen.

In consequence of these various actions the soil is left pretty rich in nitrate at the end of autumn provided the summer has been reasonably dry. If these remain they form a good supply for the young plants of the following season. But in a wet winter they are washed out and the young plant is deprived of some of its food. We thus have part of the explanation of the harmful effect of a wet winter, and one of the reasons why the husbandman in all ages has hoped for dry winters. "A fine winter," to quote from the *Georgics*, written over 200 years ago, "should be the farmers' prayer. From winter dust comes great joy to the corn, joy to the land." Again, the man of science has annotated the fact, and SIR WILLIAM SHAW has worked out a mathematical expression showing how much damage is done on an average by winter rain.

From time to time it has been alleged that substances are produced in the soil harmful to bacteria. It is possible that something of this sort may occur in really sour, badly drained soils, but there is no evidence of their existence in normal soils.

There is, however, considerable evidence that the growing plant exerts a depressing effect on the soil organisms. Rigid comparisons are not easy, but when the conditions on a fallow plot are made to approximate as closely as possible to those on a cropped plot it is found that there is more activity on the fallow plot.

It is not clear from the experiments how the action takes place: whether the plant simply exercises some indirect effect on the temperature or moisture supply, or whether it directly influences the soil organisms. On the whole the evidence rather tends to indicate a direct action such as might be brought about by a poison given off from the root or left by the plant, or by the removal by the plant of some substances necessary for the bacteria.

Further experimental work is in hand on this matter. The effect of the plant on soil bacteria recalls the remarkable effect of one growing crop on another observed by MR. PICKERING. It is obviously impossible to say that these actions are identical, but at least we may hope that the further investigations of each of these problems will throw light on the other.—

THE GARDENERS' CHRONICLE.

MANURING OF FLAX.

The experiments conducted by the Department (Agricultural and Technical Institute for Ireland) from 1901 to 1912, showed the application of potassic manures to the flax crop to give profitable increases; kainit and muriate of potash, which were about equal in value, gave better results than sulphate of potash. There was no difference in the results from the first two whether they were applied in winter or at the time of sowing.

The use of phosphatic manures was almost invariably attended with a loss, owing to the encouragement of the growth of weeds; and the application of agricultural salts was not remunerative.

Variable results were obtained in different seasons and at different centres with sulphate of ammonia, and the 1913 experiments were, therefore, designed to test this manure further. On the average of 10 centres a higher yield of 3 st. 11 lb. of scutched flax per acre resulted from the application of ½ cwt. sulphate of ammonia per acre in 1913, which left a profitable increase of £1 4*s*. 3*d*. after deducting the cost of the manure.

The addition of ½ cwt. sulphate of ammonia to dressings of 1½ cwt. and 1 cwt. muriate of potash per acre gave, on the average, increased profits over those from the potash dressings alone of 11*s*. 11*d*. and 13*s*. 8*d*. per acre. These and former results are taken to show that in most seasons the addition of a light dressing of sulphate of ammonia to muriate of potash will prove effective.

More remunerative results were obtained in 1913 from the application of 1½ cwt. muriate of potash than from 1 cwt. of this manure per acre, whether applied alone or along with sulphate of ammonia.—JOURN. OF THE BD. OF AGRICULTURE.

CORRECTING ACIDITY IN SOILS.

The question of acidity in soils and the best way of remedying this has of late aroused much interest. The use of lime at Woburn both in the field work and in pot-culture experiments has frequently been referred to, and it has been shown how the acidity caused by the prolonged use of sulphate of ammonia on a soil naturally poor in lime can be entirely corrected. At the same time, certain anomalies have appeared during the progress of the field experiments, notably in the case of plot 2bb (continuous wheat) where the application of four tons of lime per acre (two tons per acre in December, 1897, and a repetition of this in January, 1905), has not as yet produced such a good crop as that on plot 2b, where a single application of two tons of lime per acre was made in December, 1897, and not repeated since.

Seeing that in these field experiments lime had always been applied in the caustic state, this seemed to indicate the possibility of harm being done by the use of lime in the caustic state to this extent.

This deterioration, while occurring in the case of wheat, was not, however, found with the barley crop, the repetition of two tons of lime per acre having produced no harmful effect, but, on the contrary, having yielded a much increased crop.

It was accordingly resolved to carry out at the Pot-culture Station further experiments on this point, and chiefly with a view to seeing whether carbonate of lime in place of caustic lime, and in what amounts, would be beneficial in correcting the acidity of the soil. In the meantime, DR. HUTCHINSON, of the Rothamsted Experimental Station, had worked out a new method for the estimation of the acidity of soils, and, having been supplied with soil from several of the Woburn plots, he calculated in them the amount of acidity in terms of carbonate of lime, and kindly supplied the figures for use in these new experiments.

For the purposes of the experiments soil was taken from the following continuous barley plots of Stackyard Field :—

Plot 1. Unmanured.
,, 2a. Sulphate of ammonia alone.
,, 2bb. Sulphate of ammonia with four tons of lime per acre.
,, 5a. Mineral manures and sulphate of ammonia.
,, 5b. As 5a, with four tons of lime per acre,
,, 8aa. Mineral manures and sulphate of ammonia (double-dressing) together with four tons per acre of lime.

For more detailed information regarding the several plots reference may be made to Table II (continuous barley) in the present Field Experiments report (page 289).

It was determined to carry out three methods of treatment in the case of each soil. In the first of these the soil as it occurs in the field and without further treatment was taken. In the second case carbonate of lime was added in the quantities ascertained by DR. HUTCHINSON to be sufficient to just neutralise the soil acidity. In the third case carbonate of lime was added to 50 per cent. in excess of the figures supplied by DR. HUTCHINSON, lime thus being in marked excess.

The carbonate of lime (chalk) was in each case ground up finely and intimately mixed with the whole of the soil used in each pot. Earthenware pots, each holding 34 lb. of soil, were used. On April 14, 1914, barley was sown, 12 seeds per pot, the plants, being, later on, thinned to six per pot.

The crops grew well throughout ; the chief points of difference observed during the growth are given below, and the crops were cut on August 26, 1914, and weighed. The results are given in the following table :—

Plot.		No. of ears.	No. of grains.	Weight.	
				Corn.	Straw.
				Grammes.	Grammes.
1.	Untreated ...	14	192	7·86	13·88
	Neutralised ...	11	218	9·05	12·57
	Excess lime ...	16	224	8·37	13·57
2a.	Untreated ...	6	26	·75	1·75
	Neutralised ...	19	314	13·48	14·75
	Excess lime ...	22	321	13·00	19·20
2bb.	Untreated ...	17	283	12·32	16·52
	Neutralised ...	16	240	10·73	17·50
	Excess lime ...	18	297	11·42	15·95
5a.	Untreated ...	15	155	7·00	14·65
	Neutralised ...	18	257	11·35	17·93
	Excess lime ...	21	336	15·40	18·80
5b.	Untreated ...	16	273	11·81	16·93
	Neutralised ...	17	294	12·32	16·80
	Excess lime ...	15	278	11·87	14·80
8aa.	Untreated ...	19	286	11·90	19·50
	Neutralised ...	16	226	10·05	17·95
	Excess lime ...	18	309	14·60	17·80

Plot 1 (no treatment), 1·2 tons carbonate of lime required per acre.

There were no great differences observed during growth. If anything, the neutral and excess lime crops had a better colour. The harvest results showed no marked differences, though, from the returns, as compared with those of other plots, it was clear that the land wanted manuring.

The need for the addition of lime, even to the extent suggested by DR. HUTCHINSON was not clearly brought out.

Plot 2a (sulphate of ammonia alone), 2·60 tons of carbonate of lime required per acre.

This soil came from a plot on Stackyard Field, which, for several years past, has never been capable of bearing a crop, no lime having been applied to it, while sulphate of ammonia has been used every year.

In the untreated pot the crop at first came quite well, but then rapidly fell off and died away just as it does in the field.

Where the soil was just neutralised, the crop was markedly better, and still better where lime in excess was used, the tillering of the plant being more marked. The harvest results showed an almost entire failure of crop when untreated, but both the neutral and excess lime crops were large, and practically as good as any in the whole series. There was but little difference between them in corn, but the excess lime produced much the most straw. It would appear from these results that it is only lime which the soil requires, and that there is plenty of nitrogen present for plant needs. Also that lime may be safely used in excess.

Plot 2bb (sulphate of ammonia with 4 tons of lime per acre), ·40 ton carbonate of lime required per acre.

The crops here all grew well, and there were no marked differences. It was clear from the harvest results that this plot has quite sufficient lime in it.

Plot 5a (sulphate of ammonia and minerals, without lime), 1·80 tons carbonate of lime required per acre.

During the period of growth the neutral and excess lime crops were much in advance of the untreated. This was shown at harvest, when, of the two lime sets, the excess lime one was the better both in corn and straw. It would appear that this soil needs a large amount of lime, and more than is required in the case of plot 2a.

Plot 5b (sulphate of ammonia with minerals and 4 tons of lime per acre), no carbonate of lime required to neutralise.

The crops here were all good, the differences being but little marked either during growth or at harvest. It would appear from the results that lime has already been given in sufficiency.

Plot 8aa [sulphate of ammonia (double dressing) with minerals and 4 tons of lime per acre], no carbonate of lime required to neutralise.

The crops were fair. The excess treatment seemed to show slightly the better crop. The harvest results were somewhat contradictory and a certain amount of uncertainty must attach to these, as the excess lime crop, while giving the most corn, produced the least straw. It is doubtful, indeed, whether this plot needs liming at all.

Putting together the general results, the conclusion may be come to that where the soil acidity has gone to the extent that a crop cannot be produced—as in the case of plots 2a and 5a—lime, as carbonate of lime, may advantageously be added to an extent exceeding that required to neutralise the acidity present; but that where—as in plots 1 and 2bb—acidity may be indicated, but a fair crop be still produced, there is no advantage from adding lime as carbonate of lime even to neutralising point. Lastly, when—as in plots 5b and 8aa—no acidity is shown, further liming is thrown away. In no case was there, when using carbonate of lime, the harmful effect produced in the case of plot 2bb of the Continuous Wheat series, and due, no doubt, to the causticity of the lime applied.—JOURNAL OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

COMPOSITION AND VALUE OF LIQUID MANURE.

The chemical composition of liquid manure as produced under the farming conditions of the North East of Scotland is discussed in a bulletin* published by the North of Scotland College of Agriculture, and an account is given of the results obtained over a series of years with this manure for the hay crop.

Liquid manure, it is explained, consists mainly of the urine of animals and of the drainage from manure heaps during the rotting of the dung, mixed in many cases with rain water. The urine is the most important part, and contains both nitrogen and potash, but very little phosphate. Its potash content has increased the value of urine since the outbreak of war, as German sources of potash manures have been cut off.

The quality of the urine depends to a large extent upon the amount of water taken by the animal with its food. Turnips, e.g., contain about 90 per cent. of water, and as it has been repeatedly shown that from 50-60 lb. of turnips contain sufficient water for the requirements of bullocks, it follows that the larger the quantity of turnips above this consumed, the poorer is the quality of the urine. Two experiments, in Scotland and England respectively, are cited by PROFESSOR HENDRICK to illustrate the point. The amount and quality of the urine obtained in these experiments by varying the root feeding is shown in the following tables :—

SCOTTISH EXPERIMENT.

Food per Day.			Excretion.		Urine Content in	
Turnips.	Straw.	Linseed Cake.	Dung.	Urine.	Nitrogen.	Potash.
lb.	lb.	lb.	lb.	lb.	Per cent.	Per cent.
119	9½	0	29	58	0·22	—
60	13¼	3	30¾	15¼	0·58	—

* North of Scotland College of Agriculture, Bull. No. 19. *The Composition and Value of Liquid Manure:* PROFESSOR JAMES HENDRICK.

ENGLISH EXPERIMENT.

Food per day.			Excretion.		Urine Content in.	
Mangolds.	Lucerne Hay.	Water.	Dung	Urine.	Nitrogen.	Potash.
lb.	lb.	lb.	lb.	lb.	per cent.	per cent.
150	0	0	42	88	0·124	0·597
0	26	66	48	14	1·54	1·69

In districts, therefore, where dry foods are mainly used and roots are given only in small quantity, or not at all, the bulk of the urine is small, easily soaked up in the litter, and retained in the dung. Under such conditions the dung is enriched by the nitrogen and potash of the urine and it is less necessary to make special arrangements for dealing with liquid manure.

The importance of the proper collection of the urine where large quantities are produced is increased by the consideration that the nitrogen in the roots, which produce these large quantities is very well digested, so that only 10 or 20 per cent. of the total nitrogen is contained in the dung, at least 90 per cent. of the remainder being voided in the urine; and the same holds true as regards the potash. Further, the nitrogen and potash in the urine are in a form immediately available for the use of crops, so that both these manurial ingredients are, weight for weight, as valuable and as quick-acting as those of any other manure the farmer can purchase. The nitrogen and potash in the dung and the straw are, on the other hand, relatively slow in their action on crops.

In the present investigation 35 samples of liquid manure from farms in the North East of Scotland were analysed, with the following results:—

	Average per cent	Maximum per cent.	Minimum per cent.
Water	98·21	99·33	96·46
Solids	1·79	3·54	·67
Total Nitrogen	·204	·470	·088
Including Ammoniacal Nitrogen ...	·179	·410	·060
Phosphoric Acid	·029	·090	·004
Potash	·462	1·030	·128
Lime	·019	·043	·003

In the feeding a considerable quantity of turnips was used, together with straw, and sometimes a little hay; oats and various kinds of cake were added to this basal ration, and in the case of milking cows some "draff" (wet grains) was also used. The varying amounts of rain water which gained access to the collection tanks in different instances caused much greater differences in the composition of the various samples than the feeding; so far as the evidence went, however, it did not indicate that even if rain were entirely excluded from the tanks the average solids would be much higher than 2 per cent. or the average nitrogen above 0·3 per cent.

The weight of 1,000 gallons of liquid manure would be about 10,000 lb. or nearly $4\frac{1}{2}$ tons. This quantity would contain :—

Nitrogen, about ...	...	...	$20\frac{1}{2}$	lb.
Phosphoric acid, about	...	...	3	,,
Potash ...	...	...	$46\frac{1}{4}$	,,
Lime ...	..	...	2	,,

The content of nitrogen would be equal to that present in 100 lb. of sulphate of ammonia, and, on the basis of 7*d.* per lb. of nitrogen, would have a value of 12*s.* The potash is more than that present in 3 cwt. of kainit, and at the pre-war price of 2*d.* per lb. might be valued at 8*s.* The value of the phosphoric acid present would be about 7*d.*, while the lime would have practically no value. Liquid manure as collected in the North East of Scotland would, therefore, have a value of about 4*s.* 6*d.* per ton as manure, reckoning the potash at pre-war prices, or of about 6*s.* 3*d.* per ton, assuming potash to have doubled in price.

Liquid manure is suitable for a good many crops, but hay was chosen for these experiments on account of the ease with which the results of application could be ascertained. The applications were carried out at different times during the winter, viz : (1) in December, (2) at the end of January, and (3) in March, as it was thought that in the case of the two earlier dressings, in spite of assertions by practical men to the contrary, little of the potash would be lost and that a great part of the nitrogen might also be saved. The standard dressing of liquid manure adopted was 2,000 gallons per acre, which was generally given in two dressings of 1,000 gallons each at an interval of a few days. For distribution purposes a barrel-cart was used.

In all, twelve experiments were carried out over four seasons, and in every one a marked increase of crop was obtained from the application of liquid manure; further, the increase obtained by applications in December was, on the average, about as great as that obtained from March applications. This is brought out in the following table :—

	Time of Application.	Weight of Hay per acre.
		lb.
Untreated ..	... ...	4,512
2,000 gal. per acre.	December	5,557
2,000 ,, ,, ,,	January or February ...	5,768
2,000 ,, ,, ,,	March	5,610
1,000 ,, ,, ,,	December	5,719
1,000 ,, ,, ,,	March	
2,000 ,, ,, ,,	December	6,075
2,000 ,, ,, ,,	March	

With fine, mild weather early in the season plots receiving an early dressing began to grow early and obtained a start over those dressed later : but with a cold and wet early season the advantage of the early-dressed

lots was more or less lost; while with dry weather in May and June the plots dressed late, especially on light, thin land, were retarded by the drought, and the advantage of the plots dressed early was increased.

For practical purposes, therefore, PROFESSOR HENDRICK recommends dressing at intervals throughout the season as might be found convenient, each part of the area being gone over two or three times in the course of the winter.

From the financial point of view the experiments showed that (valuing the hay at 15*s*. per ton) about 25*s*. per acre was obtained from an application of 2,000 gal. of liquid manure, quite apart from the value of the improved aftermath, which was undetermined, but estimated at 5*s*. per acre. If the unexhausted value of the potash is placed at one-half the original dressing (i.e., 8*s*. per 2,000 gal. at pre-war prices) the total return would seem to have been about 38*s*. from the liquid manure, the value of which, based on its manurial ingredients, was placed at £2 (see above).

The dressing of 4,000 gal. per acre was shown to give an insufficiently good return for the extra 2,000 gals. applied (see above table).

Treatment with liquid manure had a beneficial rather than a detrimental effect on clover.

In conclusion, PROFESSOR HENDRICK points out that when liquid manure is applied to pasture, the latest dressing would require to be given some weeks before the cattle are to be turned on to the grass, so that all trace of the liquid manure and its smell, which would probably interfere with the relish of the cattle for the grass, would have had time to disappear. Probably it would be an additional benefit, in the case of pasture, than an early growth would be obtained which would provide food for stock at a time of year when it is often scarce.—JOURN. OF THE BD. OF AGRIC.

GREEN MANURING.

H. C. SAMPSON.

The extension in the practice of growing green manure crops on wet land, to be ploughed in as a manure for the succeeding paddy crop, has of recent years been most marked and with its extension this department has gained considerable experience in how best to grow green manure crops and what is their effect on the following paddy crop.

The results obtained from the use of green manure crops are very variable and they lay stress on the value of this method of manuring in improving the texture of the soil. Many wet soils are naturally rich in plant food, but owing to the bad texture of the soil, the paddy crop has been unable to utilise this in the past and it is only when a green manure crop has been grown and ploughed in that the texture and consequently the drainage of the soil improves and the paddy crop is enabled to benefit by this. This is most marked in the case of saline land. Such land is often very rich, but owing to the bad drainage and the presence of salts which check the growth of paddy, this latter crop is unable to utilise the plant food present. A green manure ploughed into such soils greatly improves the texture and the drainage. The injurious salts, all of which are very soluble in water are washed out and this

enables the paddy crop to make use of the plant food in the soil. This year Daincha (Takkaupundu) grown as a green manure crop on saline land near Sholavandan and ploughed in, so improved the texture of the soil that a yield of 850 Madras measures per acre was obtained. This piece of land had never been known previously to give a greater yield than 175 Madras measures per acre: an increased yield of nearly five times any previously recorded yield. Yet on sweet land where Daincha has been used, it has given no greater yields than ordinary methods of manuring. What is the reason for this? Sweet land is usually well drained land. Hence previous paddy crops have taken as much plant food from the soil as they can. That is to say, sweet lands are in reality much more exhausted than badly drained lands. They, however, respond very readily to general manuring and under good treatment will continue to yield bumper crops. Now a green manure crop by itself is not a general manure. Those recommended by the department are able to form nitrogenous compounds from the air and such nitrogenous compounds are a very valuable manure. In fact nitrogenous manures cost very much more to buy than any kind of manure. But beyond this a green manure crop does not supply the soil with any plant food which was not already present in the soil. Now paddy grown year after year on the same land removes from the soil large quantities of phosphorus, and the heavier the yield of paddy, the more prosperous will the crop remove. Hence all old wet land, provided it is well drained, is usually found to be very deficient in phosphorus and if this is supplied along with the green manure crop, heavy yields may be expected.

The leaflets of this department as well as articles in previous calendars all emphasize the value of phosphatic manures for paddy. This can be supplied by manure manufacturers in several forms, such as, superphosphate of lime, concentrated superphosphate of lime, basic superphosphate of lime, bone meal, and ground Trichinopoly mineral phosphate. The first three mentioned are much more soluble, i.e., the paddy crop can much more readily utilise these as plant food and as these are concentrated manures, only small quantities from 100 to 200 lb. per acre need to be applied.

As to the best method of growing green manure crops, this varies under different conditions. At one time, the department recommended that the land should be ploughed and the seed sown with the help of a rain or with irrigation, but neither rain nor water are always available. Excellent results are now being obtained by sowing the green manure crop in the standing paddy crop before harvest while the soil is still wet. By sowing in this way, the seed germinates in the shade of the paddy and the young plant can send down its roots into the moisture below before the land becomes too dry. If the sowing is delayed until after the paddy harvest, the exposed surface of the ground soon dries up and the young seedling has not much chance of developing.

In some places where irrigation is supplemented by wells and where the wet lands are utilised for growing dry cereals after the harvest of paddy, excellent results have been obtained by sowing the green manure crops along with the dry cereal. This certainly diminishes the yield of the cereal, but with the help of the irrigation given to the latter, the green manure crop grows luxuriantly and its value as manure much more than compensates for the loss of grain.

As to the choice of green manure crops, this depends very largely on local conditions. If it is single crop wet land, and the green manure seeds are sown before the harvest of the paddy, then a crop is required, which will continue to grow for nearly six months. On light or loamy soils which are well drained and do not crack, kolingi or wild indigo will probably give best results. If the soil is heavy or saline, local Daincha (Takkaipundu) will probably do best. Indigo also gives very good results on heavy land and often a cutting is taken of this to manure first crop paddy seed beds while the second growth is allowed to come up and is ploughed in on the land on which it is grown. It is not always possible, however, to procure fresh seed o indigo. If it is on double crop land and the seed of the green manure crop is sown before the paddy harvest, Bengal or Assam Daincha seed will probably give the best results. This will be ready to be ploughed in from two and a half to three months from the time of sowing. On double crop lands where the land is vacant for only two or two and a half months, sunnhemp can be grown. This, however, will only thrive on good well drained land which can, if necessary, be irrigated. In this case, it is better to plough the land before sowing the seed. This crop will not stand water stagnation.

On very heavy delta soils which crack deeply, the department has not yet been successful in raising green manure crops though there is evidence that if this difficulty can be overcome green manuring will prove of immense value on such land.

When green manure crops are ploughed into the land, they should be given ample time to rot in the soil. Ryots know from experience that when they apply green leaves to wet lands these must be given time to rot before the paddy crops are transplanted. This is even more important in the case of green manure crops as these are quite fresh and succulent when they are ploughed in. On light and loamy soil a week to ten days at least should be allowed, but on stiff and heavy soils, at least from fourteen days to three weeks should be allowed for the green manure crop to rot.—AGRICULTURAL CALENDAR, 1915–16.

CEYLON SCHOOL GARDENS.

The number of Government School Gardens has now risen to 286, and 53 grant-in-aid schools have been registered for inspection for the school garden grant payable by the Education Department.

Good progress has been maintained in the majority of school gardens, some of which have shown remarkable improvement. Owing, however, to the suspension of travelling due to the reduction of the vote, the steady work done during the past fourteen years may, I fear, have been seriously affected. The Director of Education has kindly adopted the suggestion that his school inspectors should send me reports on the condition of the gardens.

The Junior Agricultural Reader prepared at the request of Government has been adopted in Government vernacular and Anglo-vernacular schools. The Senior Reader referred to in my last report is in the hands of the Government Printer:—ANNUAL REPT. OF THE SUPDT. OF LOW-COUNTRY PRODUCTS AND SCHOOL GARDENS, CEYLON, 1914.

SCHOOL OF TROPICAL AGRICULTURE, PERADENIYA.

DRAFT PROSPECTUS.

The following is the draft Prospectus of the School of Tropical Agriculture which is to be opened at Peradeniya, in January next. :—

Principal.

THE DIRECTOR OF AGRICULTURE.

Vice-Principal.

C. DRIEBERG, B.A., F.H A.S.

Lecturing and Demonstrating Staff.

STAFF OF THE DEPARTMENT OF AGRICULTURE.

ENTRANCE.

Candidates for admission must be at least 17 years of age and must have passed the Eighth Standard of the Education Department or its equivalent in a private school.

FEES.

The inclusive fee for board and tuition is Rs. 30 per mensem; for tuition only Rs. 7·50 per mensem. Fees are payable in advance. There is accommodation for a limited number only of boarding students.

HOURS.

The school hours are as follows :—

6·20 a.m.	Muster.
6·30—8 a.m.	Note books.
8—10·30 a.m. ...	Demonstrations and Lectures.
11 a.m. ...	Breakfast.
1—2 p.m.	Lectures.
2—3 p.m.	do.
3—4 p.m.	Laboratory work.
7 p.m. ...	Dinner.
8—9 p.m.	Preparation.
10 p.m.	Lights out.

Boarders are required to be within doors by 7 p m.

Students late for muster will be fined 10 cents. The list of late fines in each week will be posted up on Saturdays.

There is no regular work on Saturdays. Students muster as usual and thereafter are expected to employ themselves during the morning in the grounds of the Royal Botanic Gardens, the Experiment Station or schoo l house. Expeditions may be undertaken by permission.

PLOTS.

Each student is required to cultivate himself a plot of land growing thereon various economic products. Marks will be awarded for the plots which will be taken into account for the school certificate.

ARMS AND ALCOHOLIC LIQUORS.

Firearms, other than service rifles, and alcoholic liquors may not be brought into the school. Smoking is forbidden during working hours.

ATTENDANCE.

Students must attend all lectures and practical classes. Irregularity in attendance may result in loss of the terms' courses as a qualification for the School Certificate. In serious cases of irregularity the student's name will be removed from the school books.

FIELD WORK.

Students are required themselves to take part in field work connected with demonstrations as the Demonstrator or Instructor may direct.

DISCIPLINE.

Students are required to obey the orders of those in authority and to conform to the school regulations. A student breaking a regulation will be fined or detained during recreation hours. Repeated irregularities or insubordination will necessitate his name being removed from the school books.

COURSE OF INSTRUCTION.

THE SOIL.

Origin of soils. Aqueous and Igneous Rocks. Soil and Subsoil. Mineral Organic Matter. Classification (Sand, Clay, Lime, Humus and their combinations : Sands, Loams, Marls, Clays). Physical Properties (Light and Heavy, etc.) Plant Food. Analysis of Soils. Air and Water of soils. Capillarity. Tilth and Tillage. Water table. Soil Mulches. Bare Fallow. Hard Pan. Rain and Dew. Temperature. Nitrification. Nitrogen-fixing Bacteria. Denitrification. Poor and Rich Soils. Dry Farming.

MANURES AND MANURING.

General Introduction. Farm-yard Manure. Artificial Manures. Nitrogenous Manures (Guanos, Cakes, Fish, Blood, Mineral Manures). Phosphatic Manures (Superphosphates, Bones, Phosphatic Guanos, Basic Slag). Potassic Manures (Potassium Sulphate, Kainit, Potassium Chloride, other sources of potash). Common Salt. Lime and Limestone. Application of artificial manures (quantities, seasons, methods). Dominant manures for certain crops. Green Manuring. Warping.

THE PLANT.

Root, kinds of roots, functions of roots, stem, kinds of stem, climbing and running stems, underground stems, tubers, bulbs, suckers, function of stems, leaves, general characters, kinds of leaves. Flowers, general description. Fruits, general description, kinds of fruits. Seeds, kinds of seeds. Germination and germinating capacity. Selection and Identification. Gramineous plants. Leguminous plants. Palms. Other Important Natural Orders. How plants feed. Absorption by Root Hairs. Importance of waters. Sap. Transpiration. Starch and Sugar. Cellulose. Plant Cells. Formation of seed, wood, latex, etc., Weeds and Vegetable Pests.

CHEMISTRY.

Gases, Liquids, Solids, Atmosphere, Hydrogen, Oxygen, Carbon, Nitrogen, Phosphorus, Potassium, Sodium, Aluminium, Calcium, Iron, Acids, Bases, Salts, Nitric Acid, Nitrification, Nitrates, Ammonia. Phosphates, Potash, Carbon-di-oxide, Salt, Sand, Clay, Lime, Humus, Water Starch, Sugar, Proteids, Fats and Oils.

ECONOMIC PRODUCTS.

Low-Country Products.—Tobacco, Paddy, Cotton, Pulses, Millets, Arrow-root, Sago, Cassava, Maize, Gourds, Root Crops. Tropical Vegetables, English Vegetables, Fodder Grasses, Sugar Cane, Condiments, Oilseeds, etc.

Estate Products.—Coconuts, Rubber, Tea, Cocoa, Coffee, Fibres, etc

Fruits (Tropical).—Anonas, Citrus, Guavas, Mangoes, Mangosteens, Melons, Papaw, Pineapples, Plantains, Brazil-nuts, Butter-nut, etc. *(Sub-Trpoical).*—Cherimoyer, Tree-tomato, Mountain-papaw, Persimmon, Hill guava, Cape-gooseberry, Passion-fruit, Peach, Pears, etc.

Drugs and Medicinal Plants.—Cubebs, Ipecacuanha, Kola-nut, Cinchona, Nux vomica, Sarsaparilla, Senna, Jalap, Croton-oil, Principal medicinal plants of Ceylon, etc.

Poisonous Plants as Datura, Arrow-poisons, Dumb-cane, Gloriosa, Cerbera, Laportea, Modecca, etc.

Spices and Condiments.—Allspice, Cardamoms, Cassia-bark. Cinnamon, Clove, Ginger, Grains of Paradise, Nutmeg (including mace), Pepper, Star-anise, Turmeric, Vanilla, Aniseed, Caraway, Coriander, Cummin, Mustard, Garlic, etc.

AGRICULTURAL ENGINEERING.

Metric system. Chain and Arrows. Measuring land. Plotting Scales. Simple Plotting. Calculation of Areas and Solids. Road Tracing.

Ploughs, Harrows, Tools, Pumps, Oil Engines, Steam Engines.

Irrigation and Drainage, Water Loggings.

THE ANIMAL.

Anatomy. Physiology. Common Diseases. Management and Feeding.

CO-OPERATION.

Historical sketch. The Co-operative Ordinance. The Organising of Societies. Co-operation in Agriculture. Co-operation in Industries. Co-operation and Social Progress. The Working of Societies. Accounts and Books. Inspection and Supervision. Credit Loans and their repayments. Deposits.

CROP PESTS.

Coconuts.—Rhinoceros Beetle, Red Weevil, Coconut Nephantis, Coconut Aphis, Palm Butterfly.

Tea.—Shot-hole Borer, Red Borer, Tortrix, Red Slug Caterpillar, Lobster Caterpillar, Nettle-grubs, Leaf-mining Fly, Tea Mosquito, Red Spider, Yellow-mite, Purple-mite, Tea-eelworm.

Rubber.—Long-horned Boring Beetle, Black scale insect, Spotted Locust, Large Cockchafer.

Cocoa.—Helopeltis Bug (Same as Tea Mosquito), Pod-boring Moth, Shot-hole Borer, Bark-eating Borer.

Paddy.—Paddy Fly, Paddy Grasshopper, Paddy cutworm, Paddy Butterfly, Rice Skipper, Rice Case Worm, Paddy Borer.

Cotton.—Red Cotton Bug, Cotton Beetle borer, Pink bollworm, Spotted Bollworm, Cotton leaf-roller, Cotton bud caterpillar, Cotton Aphis.

Tobacco.—Tobacco leaf-caterpillar, Tobacco Stem-borer, Tobacco cut-worm.

Fruit.—Fruit flies, Scale-insects, Mango-hoppers, Mango weevil, Lemon caterpillar.

Vegetable Products.—Diamond-back Moth, Sweet-potato Weevil, Red leaf beetle, Black leaf beetle, Brinjal leafbug, Cutworms, Brinjal Fruit Borer, Dorylus Ant, Pumpkin Fruit-fly.

PLANT DISEASES.

Diseases caused by various organisms. Parasites and Saprophytes, Obligate and Facultative, Wounds and function of bark of plants. Epiphytes, Lichens, Orchids, Ferns, Epidemics. Damage to crops and loss entailed. Quarantine. Legislation and Diseases.

Causes of Disease.—Fungi, Bacteria, Plants, Physiological.

Fungi.—Brief sketch of morphology and classification.

Bacteria.—Bacterial diseases.

Plants.—Parasites.

Physiological.—Fasciation, Chlorosis, Wound effects, nodules.

Symbiosis.—Mycorrhiza. Root tubercles of Leguminosæ, Lichens.

Control.—Fungicides, Treatment.

CEYLON DISEASES AND TREATMENT. *Hevea.*—Wet season bark rot on tapping surfaces, Leaf fall and Pod Disease. Fomes, Brown Root, Sphærostilbe. Dieback, Botryodiplodia, Pink Disease, Canker.

Tea.—Shot-hole fungus, Brown Blight, Gray Blight, Red Rust, Horse-hair Blight, Massaria. Botryodiplodia, Brown Root Disease, Poria, Rosellinia Ussulina.

Cocoa.—Canker, Botryodiplodia. Brown Pod, Botryodiplodia. Brown Root Disease.

Coconuts.—Gray Blight, Bud Rot. Stem bleeding. Fomes lucidus.

Coffee.—Hemileia.

Diseases Various.—Grevillea, Dadap, Albizzia, Acacia decurrens, Casuarina. Jak, Citrus, Mango, Plantain. Clove, Nutmeg, Cinnamon, Tobacco, Cotton.

DEMONSTRATIONS.

HORTICULTURE.

Seed Sowing.—Season, Selection of seed, suitable soils, germinating periods, preparation (filing, etc.,) acquatic seeds, etc.

Rootstocks, Suckers, etc.—Methods, division, replanting, suckers, leaves, eyes, tubers, rhizomes, etc.

Cuttings.—Season, condition of shoot, preparation, compost, succulents, etc.

Layers.—Methods, selection, conditions, seasons for.

Gootee Layering.—Selection, season, materials, etc.

Grafting.—Methods, selection of stock and scion, conditions and seasons, composts.

Inarching.—Method, selection, mode.

Budding.—Season, condition of eye and branch, forms of budding.

Pruning.—Objects and principles, periods, lopping and pollarding, thinning, root pruning.

Planting.—Seasons, preparations, holing, shading, watering, distances, mulching, surface dressing.

Transplanting.—Seasons, preparations, guards and supports, shading, watering, etc.

Pots and Pot Culture.—Selection of pots, seed pans, etc., compost, orchid potting, conditions for syringing, watering, plant labels.

Packing and Transporting of Seeds and Plants.—Packing materials, preparation of seed, acquatic seeds, preparation of cuttings, label and stencilling, packing and transportation, puddling.

Storing of Seeds.—Seed collection, selection, vitality methods.

Renovating of Paths and Roads.—Foundation, drains, culverts, silt pits, gradient.

Tree Felling and Charcoal Burning.—Methods of felling, stump extraction.

Nurseries.—Position, water, shelter, soil, preparation of beds.

Garden Tours.—Study of growth, habits, peculiarities of trees and shrubs, adaptations.

Garden Making.—Selection of site. Laying out hedges, boundaries, screens, etc. Selection of ornamental plants for borders, trees and shrubs, climbers, etc. Palms. Lawn making.

Useful Trees.—Trees for shade or ornament, for wind belts, for fuel, for timber, for road-side or street planting, for sea-side, for dry region, for up-country.

PLANTING.

Tea.—Nurseries; holing and planting of tea-stumps, pruning, burying prunings, tipping and picking.

Rubber.—Nurseries ; holing and planting rubber-stumps, spacing, mulching and forking, marking out trees for tapping, tapping, collecting scrap, various methods of tapping. excision and incision, periods of tapping, bark renewal, coagulation, rolling, drying, creping, packing, care of rubber-room, smoking, grading.

Cocoa.—Selection of seed pods, preparation of bamboos or baskets, planting, care of nursery, holing, planting out, spacing, planting at stake, temporary shade, permanent shade, varieties, pruning, shade-topping, picking, breaking, burying pods, fermenting, washing, drying, grading, packing.

Coconuts.—Seed selection, nurseries, holing, planting, cultivation, ploughing, discing, beetle traps, picking, husking, shelling, drying, selecting, packing, oil-pressing.

Coffee.—Planting in baskets, and care of nursery, holing, planting out, shading, varieties, picking, pulping, drying.

Plantains.—Varieties, suckers for planting, holing, planting, Ceylon method, West Indian method, suckering, manuring, fruiting, cutting, packing.

Vanilla.—Planting, shading, mulching, training, fertilising, thinning pods, harvesting, drying and fermenting.

Fibres.—Bulbils, suckers, planting, spacing, harvesting, preparation.

Fruit Orchard and Vegetable Garden.—Digging, forking, trenching, raking, manuring, manure-heap, compost and leaf heap, mixing, seed boxes, potting, fruit-tree pruning, pine culture, beans, bean-fly, soya bean, beets, other root culture.

Paddy.—Irrigation, draining, ploughing, levelling, broadcasting, transplanting, nursery, seed selection, harvesting, threshing, winnowing, storing, straw stacking.

Grains.—Maize, sowing, sorghum, sowing, culture, leaf-fodder cutting, harvesting, threshing, storing.

Sugar-cane.—Method of planting, cultivation, cutting, ratooning.

Papaw.—Planting, tapping for papain.

Dynamiting.—Dynamiting for planting, for sub-soiling, blasting rocks and stumps.

SCHOOL CERTIFICATE.

The course of instruction covers a period of one year divided into three terms corresponding approximately with the terms of the Education Department Schools, that is to say approximately 2nd week January to 1st week April, 1st week May to 1st week August, and 4th week August to 2nd week December. There will be three examinations in the year, one at the end of each term. To gain the school certificate students must have completed the course and obtained a pass at each examination. Every student will be required to make notes daily in books which will be examined and marked weekly by the Lecturers and Demonstrators. Students who fail to obtain a satisfactory proportion of note book marks will not be eligible for the School Certificate.

TREATING POTATOES FOR DISEASE.

In dipping potatoes for disease they may be immersed in a solution of corrosive sublimate (1 oz. to 6 gallons of water) for two hours, or sprayed with a solution of copper sulphate and washing soda in the proportion of 2 lb. sulphate, 2½ lb. soda to 10 gallons water.

In experiments referred to by the JOURNAL OF AGRICULTURE, Victoria, the tubers produced under either treatment were found to be free from scab except that caused by the eel worm, which is not affected by dipping. It is worthy of note that the yield for the untreated plot was exceeded by those which were subjected to dipping and spraying.

VISITORS TO THE PERADENIYA EXPERIMENT STATION.

Visitors to the Experiment Station included PROFESSOR DUNSTAN, Director of the Imperial Institute, PROFESSOR ARMSTRONG of the London University, and the MAHARAJA and MAHARANEE of Kapurthala. Over 300 other visitors have been shown round, which is less than half the number of last year, the decline being due to the war. Directors and members of the agricultural staffs of Cashmere, the Andaman Islands, Java, Portuguese East Africa, Japan, Malay States, Russia, and Holland have all paid visits for considerable periods to the Experiment Station, expressing their great interest in the work being carried on.—MANAGER'S ANNUAL REPORT FOR 1914.

CO-OPERATION.

THE LAND AND AGRICULTURAL BANK OF SOUTH AFRICA.

The Land and Agricultural Bank of South Africa was established by an Act of the Union Parliament, and came into existence on 1st October, 1912, on which date it took over the assets and liabilities of the Transvaal Land Bank and the Agricultural Loan Funds of the Orange Free State and Natal.

The main object of the Bank is "to assist the farming population by providing bona fide and deserving applicants with funds at a cheap rate, repayable in instalments over an extended period."

The control of the Bank is in the hands of a Central Board, with offices at Pretoria. This Central Board deals directly with the business of the Transvaal area, while local boards have been established for Natal, the Orange Free State, Eastern Cape Colony, and Western Cape Colony.

The magistrates of the Union are the agents of the Bank, which is largely dependent upon them, on the one hand, for information as to the character of each applicant for a loan, and the value of the security offered, and, on the other hand, for making known to the farmers the various kinds of advances which the Bank is authorised to make.

The minimum amount which may be lent to any one farmer is £50, and the maximum amount ordinarily £2,000, and exceptionally £5,000.

Each application for an advance must be accompanied by a valuation of the property offered as security, made by a valuer appointed by the Central Board; the cost of making the valuation is regulated by a scale of charges and falls upon the applicant. The security for loans is normally a first mortgage on land or farm buildings, and advances may be made up to 60 per cent. of the value of the security offered.

The advances are made for thirty years; during the first five years interest is paid at the rate of 5 per cent. and the borrower has the privilege of reducing the amount of the loan by repayments of £5, or any multiple of such sum, at any date upon which interest is due. At the end of five years the principal sum outstanding becomes repayable in twenty-five years in half-yearly instalments.

Besides the above "ordinary" loans, the following (among other) "extraordinary" advances may be made: (1) Cash credits to farmers for short periods for an amount not exceeding £1,000; (2) Advances for the construction of fences and dipping tanks; and (3) Advances to approved co-operative societies.

The last-named advances are guaranteed by the joint and several liability of all the members, while, as an additional security, the Bank has power to inspect the books of the Society for the purpose of ascertaining whether the funds advanced are being carefully and economically expended for the proper purposes.

These purposes are especially:—

(1) The erection of buildings and the purchase of

(a) Immovable property.

(b) Agricultural machinery to be worked on behalf of members.

(c) Breeding stock to be controlled and used on behalf of members.

(d) Plant, office furniture, and other equipment.

(2) To make advances to members against produce, actually delivered to a society in good order and condition, and carefully graded.

(3) To purchase grain bags, agricultural implements, seeds, and farming requisites to be supplied to members.

Operations from 1st October, 1912, to 31st December, 1912. In this period the number of applications for ordinary advances, which were approved, was 547, to the amount of £348,220; the number of advances actually paid out was 287, to the amount of £106,840 (i.e., £372 on the average), and secured by farm property to the value of £265,521. The purposes for which these advances were made were: For improvements, £20,124, for purchase of stock, £14,622; for discharge of existing liabilities, £49,142; for sub-division of land, £172; and for purchase of land, £22,780.

The profit made by the Bank in the period was £8,674, which, added to the reserve funds taken over from the Transvaal Land Bank and the Land and Agricultural Loan Funds of the Orange Free State and Natal, brought the reserve fund of the Bank at the end of 1912 to £88,160.

Operations during 1913. The demand during 1913 for the benefits offered by the Bank was so much beyond expectations that the funds placed at the disposal of the Central Board proved quite inadequate, and the Board could only continue to make advances after securing a large overdraft from its bankers, and an additional grant of £25,000 from the Government. The issue of stricter regulations as to the purposes for which loans could be granted failed to lessen the rate at which applications for advances increased, and the maximum amount of loans was, therefore, reduced to £500.

The Board estimated that it would require a further vote of £439,000 for the year ending 31st March, 1914, and one of £1,455,000 for the year ending 31st March, 1915, unless the maximum amount of the loan of £2,000 were permanently lowered, and it was loath to advocate this way out of the difficulty, as any such reduction would defeat the purposes for which the Bank was created.

During 1913, 2,636 "ordinary" advances were made to the amount of £1,530,060 (average £584), and against security of the value of £3,418,670. The purposes for which the loans were granted were for: Improvements £216,270; purchase of stock, £125,335; discharge of existing liabilities £662,118; and purchase of land, £525,972.

Of the "extraordinary" advances £60,246 was granted in respect of dipping tanks (though not paid in full), £102,195 was paid for fencing construction, and advances of £55,000 were made to three co-operative societies.—JOURN. OF THE BD. OF AGRICULTURE.

PROGRESS OF CO-OPERATION IN INDIA.

The following figures showing the progress of the Co-operative movement are abstracted from the "MADRAS BULLETIN OF CO-OPERATION," Vol. VI. No. 2, December 1914.

Province.	No. of Societies.		No. of Members.		Working Capital.	
	1912-13.	1913-14.	1912-13.	1913-14.	1912-13.	1913-14.
Madras	1,078	1,333	82,713 (× 198 societies)	100,537 (× 232 societies)	9,553,751	12,320,186
Bombay	615	698	46,223	66 775	4,847,763	6,613,135
Bengal	1,123	1,663	56,889	90,363	4,607,301	8,940,803
Punjab	2,845	3,333	133,780	160,892	12,809,304	18,429,096
United Provinces of Agra and Oudh ...	2,530	2,800	106,627	116,069	8,667,662	11,418,637
Central Provinces and Berar	1,449	2,213	27,571 (× 825 societies)	40,415 (× 180 societies)	3,515,046	6,509,938
Burma	1,115	1,355	31,750	37,131	5,564,523	6,610,881
Bihar and Orissa ...	595	822	30,673	50,804	1,372,212	2,287,938
Ajiner-Merwara ...	282	357	8,111	11,162	995,448	1,485,831
Total ...	11,672	14,274	524,337	674,148	51,933,010	74,616,445

The following figures showing the progress of the movement in Mysore and Baroda are given in the annual reports of Registrars of Co-operative Societies in their respective states.

Mysore	343	530	24,538	40,479	1,289,338	2,147,340
Baroda	189	262	5,465	7,749	336,612	639,837
Total ...	532	792	30,003	48,228	1,625,950	2,787,177

CATTLE CLUBS.

There are now 157 clubs for the co-operative insurance of cows in England and Wales, distributed over fifteen counties. Of these 117 have 4,582 members, with 14,316 cows and calves insured, and assets amounting to £32,656. They are organised on much the same principles as the pig clubs, membership being confined to one large parish or a small well-defined district,

Most of them probably originated in the latter half of the nineteenth century, but some few were formed earlier, and one at least has had a continuous existence for over a century. Out of the total number only twenty-two are registered, but they appear to be more permanent in character than pig clubs probably because of the greater volume of their financial business.

It is rather striking that cow clubs are generally found where small holdings, especially of an old-established character, exist in unusual numbers. For instance, a very prosperous club exists at Whixall, in Shropshire, where there are 170 small holdings in a parish of 2,300 acres, and at Friskney, in Lincolnshire, where a good club has existed for over half a century, holdings between 1 and 50 acres constitute 78 per cent. of the total number. The number of animals insured by the clubs may vary between 40 and 1,400, the average for 21 registered societies being 220, and for 86 societies, including both registered and unregistered, 115. The membership varies between 20 and 300, the average for 86 societies being 41.

The method of collecting premiums in cow clubs differs somewhat from that adopted by many pig clubs. When the member of a pig club has paid his entrance fee he pays a small subscription every quarter irrespective of whether he has animals insured or not. This arrangement has doubtless been made to preserve the continuity of the club when there is no continuity of possession of pigs by members throughout the whole year. But in the cow clubs an annual membership subscription is paid, and generally an entrance fee, and a quarterly subscription for each animal, fixed according to age or rate of insurance. The annual premium for an adult animal varies between 4*s*. and 8*s*. per annum. Few, if any, of the societies insure the full value of all animals. Some societies pay full value for some animals, but fix a maximum amount for insurance; others pay a fixed proportion of the value of each animal. The average death rate varies considerably, some localities being apparently unhealthy for cow stock, but the average is about 2·5 per cent. In 1912 the average loss per animal incurred by twenty-two registered societies was 4*s*., while the average compensation per animal dead was £8. 5*s*. This includes a small percentage of immature stock, amongst which the death rate is higher than among cows. The costs of management amount to about 6*d*. per cow, and altogether it has been proved that the cow clubs can insure stock at a cost of some 3 or 4 per cent. per annum of the total value of animals, while the insurance companies demand a premium of some 7½ per cent. While doing this many of the clubs have been able to build up considerable reserves. In 1912 eighty-six societies had funds amounting to over £10,000, while some societies have accumulated sums much larger than the average for this group. The Whixall Club had £1,500 in 1908, when it decided to reduce its reserve by making a dividend of £500 among its members. Fortunately the practice of making dividends is not so common among cow clubs as among the pig insurance societies. A scheme has recently been laid down by which cow clubs may reinsure part of their risks with a co-operative insurance company, but an increase in the number of clubs registered seems to be a necessary preliminary to any scheme of development. As in the case of the pig clubs, it seems a pity that so few societies take the advantages accruing to the process of registration, and that some attempt is not made on the part of the officials of the clubs to strengthen their position by federation, and to extend the benefits of such associations into other localities.—JOURNAL OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

POULTRY AND APICULTURE.

THE BROODY HEN.

"RED LINCOLN" treats of this subject in the SOUTH AFRICAN POULTRY MAGAZINE for June, and his practical hints are reproduced below :—

There are two main ways of hatching—natural and artificial. Nature's way, the broody hen; art's way, the incubator. Broody hens are scarce when most wanted. To ensure a good supply of early chicks, an incubator is almost indispensable, but as the majority of farmers confine their hatching to mother hen, a few words on her treatment and care first.

Make sure that your hen is really broody before you interfere with her in any way. When you first find her sitting on the nest when the rest are off to roost, leave her alone. She may be only thinking about it, and to disturb her maternal meditations at this early stage may frighten the thought right out of her head. Give her another twenty-four hours to think over it, and by that time she will usually be of the same opinion still—only more so. Meanwhile, if you are going to change her quarters, get them ready for her. This is generally necessary, for she is most likely sitting where other hens are laying, if not at present, they will most likely want to before she is through her work, and then it's a case of too many eggs, too many hens, and too few chicks.

HOW TO MAKE A HATCHING COOP.

Have a bottomless coop ready for her. This should be not less than 2 feet square and 2 feet high. It may have square sides with a pitched roof, or it may be of the inverted V pattern, which is all pitched roof. If I have a square box suitable I knock off the bottom, top and front, and convert them into the roof and the laths in front; if not, I generally knock two paraffin cases to pieces carefully and make an inverted V shaped coop. The front laths I make 1½ inches wide, and place them the same distance apart. The two middle ones slide up and down and act as a door.

Choose a quiet secluded place on short grass and make a shallow depression about the depth of a soup-plate; don't dig a hole as deep as a pudding basin. Go and look at the nest the hen made for herself; it is not a dug-out, only just a scratch-out. Now, put in a thin layer of hay or chaff; sprinkle it with some disinfectant or a good insect powder. Place a couple of dummy eggs in the nest and put the coop over so that the nest takes up one of the back corners. After sundown, and just before dark, quietly and carefully take her ladyship from the nest of her choice, dust her well with insect powder, especially among her fluffy feathers, and under her wings, and place her quietly on the nest of your approval. If she settles down quietly, you can give her the eggs you wish her to hatch the next evening.

Don't disturb a broody hen any time before sundown for the first few days. See that she has water always accessible, and changed everyday, and give her two meals a day of hard corn. White maize may safely be fed to

her; in fact, there is probably no better food, for a broody hen always loses considerable weight during her period of sitting. After two or three days the door may be opened for an hour before sundown to give her an opportunity of stretching her legs if so inclined. If she finds her way back safely, give her the same privilege next day, and more of it until she may have full liberty to please herself during the whole day, *but always make her safe for the night.* Whenever you find her off the nest, just count the eggs to see that none are broken. Should such an accident occur, take the remaining eggs and wash them in warm water, and renew the hay or chaff of the nest before replacing them. It may also be necessary to catch the hen and clean any mess of broken egg from her.

TESTING EGGS.

After the fourteenth day the eggs may be examined and the unfertiles taken away; these may be easily distinguished by taking them to a darkened room and holding each one before a light. Those that are clear may safely be discarded. It is best to have only eggs with chicks in on hatching day, and for this reason the remaining eggs may be put to another safe test on the eighteenth or nineteenth day. Place them in a dish or bucket of warm water, and if any of them come to the surface they may also be taken away. You may only have half your original eggs left, but those useless eggs, left in the nest, might cause the crippling or even the death of one or more of the chicks that are going to hatch. When the chicks commence to hatch, it is a good plan, if the hen is quiet enough, to remove the chicks from time to time and place them in a lined box or basket near the fire until the last one has made its appearance. Then remove any unhatched eggs and the egg shells from the nest and replace the chicks carefully under the hen.

COMB FOUNDATION FOR BEES.

G. S. OETTLE, writing in the SOUTH AFRICAN POULTRY MAGAZINE, furnishes the following interesting information on this subject:—

Wax foundation is provided by the bee-keeper for the simple reason that it enables the bees to build straight combs in the frames, and straight brood combs admit of easy manipulation. It is a thin sheet of wax on which the imprint of worker or drone cells has been made by machinery.

In oversea apiaries drone-comb foundation is preferred for extracting supers, but a good deal of experience with our South African bees indicate that they will not store in drone cell shallow frames, if they can possibly help it. A splendid example was instanced of this peculiarity last season. Several shallow frames had been fitted up with old comb which had been cut out from brood frames spoilt by the excessive building of drone-comb upon the bottom edges. Being undesirous of wasting this comb I trimmed it and fitted it into some shallow frames which had to be put into service at once. In the super there were twelve frames, and of these five contained some drone-built comb. It was remarkable to note how that whilst all the worker cells were filled with honey, and in many cases had been sealed over, the drone

cells were as clean as a whistle. Further experiments indicated that whilst the bees had placed honey in drone cells they only do it as a last resort, and in one super which as an experiment I had filled with purely drone comb frames, I found the brood-chamber clogged with honey, swarming prevalent and the super empty.

Wax foundation is made in several qualities : thin, medium and heavy. The thin foundation is used for the sections, and has just sufficient wax to enable the bees to draw out the cells and fill them with honey without leaving any indication of a mid-rib when the honey is being eaten. When putting foundation into the frame remember that the points of the cells' hexagons must point straight up and down, and not from side to side, otherwise in hot weather the comb is liable to break down with the weight of bees on it. Never use starters if possible, always use "full" sheets, because the comb will be even and will be worker-comb. Above all things, avoid the presence of drone-comb in the brood-chamber.

A NOTE-BOOK OF AGRICULTURAL FACTS AND FIGURES.

The above is the title of a little volume compiled by MR. R. CECIL WOOD, Principal of the Agricultural College at Coimbatore, arranged as remarked by the author of the book on lines similar to McCONNELL'S Agricultural Notebook. It contains 178 pages of information on various subjects and is intended for those engaged in agricultural investigation, instruction or demonstration in the South of India though it will certainly appeal to a much wider circle of Tropical agriculturists.

Under the heading labour will be found information regarding the time and number of persons required for extracting fibre, grinding cotton seed, husking paddy, planting canes, coconuts, chillies and other garden crops, rope-making, etc.

The important subjects of soils and manures are given due recognition and the chapter on crops deals with cereals, pulses, vegetable and garden produce, oilseeds, fibres, condiments and spices, drugs and narcotics, sugars and dyes. The book in addition to the above contains information on weights and measures ; mensuration and levelling ; machinery and buildings ; foods and feeding ; live stock with notes on some of the common diseases ; dairying ; common insect pests ; horticulture, timber trees; a most comprehensive list. It has been printed by the Superintendent of the Government Press, Madras, and is priced at 14 annas. It is of convenient portable size and we can recommend it as a companion to all practical men. The size would have been still less if no blank pages had been left. The system adopted of interleaving with blanks is, we think, out of date with modern books of reference such as this.

THE CEYLON

STATEMENT OF RECEIPTS AND PAYMENTS FOR

RECEIPTS.	Rs.	Cts.	Rs.	Cts.
To Balance at Mercantile Bank, Kandy, 31st Dec. 1913			5397	32
,, Members' Subscriptions.				
Local Subscriptions for 1910	8			
do 1911	32			
do 1912	112			
do 1913	742	60		
do 1914	3859	80		
do 1915	374	73		
do 1916	54			
,, Foreign Subscriptions	8756	16	13939	29
,, Government Grant for 1914 (3 Quarters only)			19125	
,, Interest				
On Mercantile Bank A/c			54	87
,, National Bank of India, Ltd.				
Overdraft at 31st December, 1914.			334	84
Rs.			38851	32

PAYMENTS.	Rs.	Cts.	Rs.	Cts.
By General Expenditure				
Organising Vice-President	3000			
Assistant Editor	999	96		
Proof Reader	240			
Clerks and Peons	5147	64		
Agricultural Instructors	6556	92		
Stationery	601	46		
Postage and Telegrams	2071	41		
Office Furniture	76	53		
Bank Charges and Commission	115	53		
Miscellaneous Petty Expenses	647	85		
Printing	230	96		
Auditors' Fee for 1913	200			
Transporting Bull	43	89	19932	15
,, Travelling Expenses				
Secretary and Staff	269	05		
Agricultural Instructors	8518	73		
Show Judges, etc.	226	95		
Organising Vice-President and Staff ...	123	25	9137	98
Forward Rs....			29070	13

We certify that we have prepared this account of Receipts and Payments from the books

Colombo, 13th May, 1915.

AGRICULTURAL SOCIETY.

THE TWELVE MONTHS ENDED 31st DECEMBER, 1914

PAYMENTS.			Rs.	Cts.	Rs.	Cts.
BROUGHT FORWARD					29070	13
BY TROPICAL AGRICULTURIST & MAGAZINE OF C. A. S.						
Printing English Magazine			7949	68		
.. Tamil Edition			200			
			8149	68		
Less Received for Advertisements ...			3703	68		
			4446			
Cost of Singhalese Magazine						
Editor's Fee	450	00				
Printing, Postage, &c. ...	1147	83				
	1597	83				
Less Subscriptions ...	393	27	1204	56	5650	56
.. AGRICULTURAL SHOW EXPENSES						
Grant to London			250			
Cotton Exhibit			6			
Cost of medals			327			
			583			
Less Paid on a/c of Kalutara medals ...			300		283	
.. EXPERIMENTAL GARDENS						
Paddy and Tissa Grass			95	37		
Bandaragama 200/-, Kegalla 210/36 ...			410	36		
Balangoda 165/-, Badulla 195/			360			
Jaffna 150/-, Nugawela 38/60			188	60		
Nikaweratiya 97/50, Ambalantota 241/66 ...			339	16		
Mediwake 150/-, Vavuniya 33/25			183	25		
Balalla and Hittipola			168	50	1745	24
.. APICULTURE					21	81
.. SEED STORE AT GOVERNMENT STOCK GARDEN						
Coolies' Wages and Miscellaneous Expenses					254	61
.. SERICULTURE EXPERIMENTAL FARM						
Grant to Salvation Army			125			
Sundry Expenses			189	65	314	65
.. AGRICULTURAL IMPLEMENTS					33	92
.. AGRICULTURAL TRAINING					35	78
.. CASH IN SECRETARY'S HANDS			30			
.. STOCK OF STAMPS			58	49	88	49
.. SEED SUPPLIES						
Excess Purchases over Sales						
	Purchases.	Sales.				
Vegetable Seeds	1103·03	368·49				
Paddy	58·34	52·52				
Cotton	22·20					
Grafted Plants	852·48	796·07				
Indian Corn	37·15					
Soya Beans	35·06	4·30				
Sunn Hemp	85·31					
Wheat	27·42					
Lucerne	14·92					
Grass	18·64	11·13				
Potatoes	36·50					
Coffee	390·68	256·75				
Turmeric & Ginger	35·60					
Sundries	239·61	114·55				
	2956·94	1603·81				
Excess Purchases		1353·13				
					1353	13
				Rs.	38851	32

of the Society and that to the best of our belief it is correct.

(Signed) FORD, RHODES, THORNTON & Co.

Chartered Accountants.

GENERAL.

COMMITTEE OF THE BOARD OF AGRICULTURE.

Minutes of Meeting held 31st August, 1915.

The Board of Agriculture met in Committee at 11-15 a.m. on Tuesday the 31st August, 1915.

Present :—MR. R. N. LYNE, O.V.P., in the chair ; DR. H. M. FERNANDO, HON'BLE MR. A. KANAGASABAI, DUNUWILLE DISAVA, MUDALIYAR TUDOR RAJAPAKSE, MESSRS. W. A. DE SILVA, L. W. A. DE SOYSA, K. BANDARA-BEDDEWELA, H. L. DE MEL, N. J. MARTIN, A. W. BEVEN, J. M. HENRY, D. S. CORLETT, A. BRUCE, GEO. BRYCE, L. E. CAMPBELL, JAS. PEIRIS, B. F. SCHERFFIUS and C. DRIEBERG (Secretary).

The first subject discussed was the advisability of using common salt as a substitute for potash (introduced by DR. H. M. FERNANDO).

The Acting Government Agricultural Chemist gave it as his opinion that the use of salt was not to be recommended in spite of its hygroscopic properties, and that lime was to be preferred as a liberator of potash in the soil and an aid to nitrification.

THE CHAIRMAN referred to the value of the bare-fallow as a means of conserving moisture in the tropics, and invited attention to the work done by the disc harrow at the Chilaw Coconut Trial ground. He quoted figures to prove the value of the bare over the crop-fallow.

THE CHAIRMAN also mentioned the "Chula" Copra Dryer, and invited the opinion of members present. The majority considered that there was no room for improvement in the present method of drying, which gave marketable copra at the cheapest possible cost. At present there was no encouragement to produce a white copra.

MR. D. S. CORLETT explained by means of a model the work done by the "leveller" used on paddy land in Egypt. It was pointed out that a similar implement was already in use, but that the model was an improvement on it. MR. H. L. DE MEL undertook to demonstrate the use of the new implement and report what cultivators thought of it.

CEYLON AGRICULTURAL SOCIETY.

REPORT FOR 1914-15.

The last Annual Meeting of the Society was held on 11th August, 1914, in the Executive Council Chamber, Queen's House, and was presided over by HIS EXCELLENCY SIR ROBERT CHALMERS, President.

MEMBERSHIP.

The following members joined the Society during the year :—E. Peace ; The Superintendent, Ferham Estate ; W. S. Cookson ; The New York Public Library ; John Booth ; F. W. Barker ; T. H. Obeyesekere ; Dr. M. J. de Jong ; Dr. M. J. Appaswamy ; W. Diopenheim ; Bulatgey Konnehamy ; Henry A. Peiris ; P. M. Tikiriduraya ; T. B. Madawela ; M. B. Ratwatte ; F. VanRooyen ;

T. B. Panabokke ; H. Poyntz-Wright ; The American Consul, Colombo ; George Benzie : B. Abeyesundera ; E. Long ; W. L. Mesman ; D. G. Cameron ; W. T. Samaraweera ; M. Towfique ; C. Kumbalatera ; L. B. Bulankulame ; K. S. Pantulu ; E. A. Reid ; Popular "Guaahan" Club ; M. Mooneswamy & Co. ; Rev. J. P. M. Gibson ; J. Cikot ; C. Canagaratnam ; T. W. T. Perett ; F. I. S. Sutherland ; George Farmer ; The Manager, Nan Heng Rubber Estate ; The Mexican Crude Rubber Co. ; V. Palmgren ; Okinawaken-Tokyo-Shikenjo ; E. Salis ; Taiwan-Sotokufu-Shuchikiyo ; M. P. Pitot ; M. A. Subha Rao ; J. E. Eddie ; Sam K. Dickson ; M. H. M. Samseedeen ; T. R. Wiggin ; E. C. Villiers ; E. J. Woodhouse ; The Editor, La Hacienda ; Ross Wyllie ; Rolf Smerdon ; Dodwell & Co. ; Ceylon Coconut Oil and Desiccating Co. ; J. S. Vereschagin ; S. Oxton Jones ; A. M. C. Dias ; G. H. Boultbee-Whall ; E. M. B. Seneviratne ; J. J. Wall ; R. L. Ephraums ; C. D. A. Gunawardene ; W. M. Hall ; A. C. Koorenhof ; D. Butinschaap ; A. Stephen ; M. Somasundaram ; A. B. Rickets ; G. F. Weatherston ; R. R. Wheatley ; John Cotton ; William Wicherley ; Pelmadulla Valley Tea and Rubber Co. ; J. H. Wall ; Delmege, Reid & Co. ; H. C. Wickham ; Director of Agriculture, Amloh ; Gibson Islands Ltd. ; I. A. Duff-Joss ; P. B. Rambukwella ; The Superintendent, Tismoda Group ; Meade Gilbert Stone ; Philip Shelley ; J. C. Parker ; R. Bannerman ; J. F. Dias ; C. S. Rajaratnam ; Francis Wickramasinghe ; Deputy Director of Agriculture, Konkan Division ; Phra Raja Yodha ; Principal, Agricultural College, Sabour ; A. D. Gilbert Bennett ; Mrs. W. H. Wright ; A. Robt. de Alwis ; K. N. Power ; G. B. Smitz ; Karl Krippendorff ; K. R. Fernando ; William Edward Dean ; R. H. Wijemane ; John Spring & Co. ; H. Brian ; C. Hill ; J. P. G. Kruyt.

The total number at date is 1,590—Local 860, Foreign 730, representing a decrease of 293, mainly due to the names of enemy subjects having been struck off the list.

The following statement shows the distribution of local and foreign members :—(*Local*) Western Province (323); Central Province (239); Southern Province (57) ; Northern Province (23) ; North-Western Province (38) ; Province of Sabaragamuwa (55) ; Eastern Province (14) ; North-Central Province (17) ; Province of Uva (57). (*Foreign*) England (69) ; Scotland (8)); Ireland (4) ; New Zealand (3) ; France (11) ; Siam (6) ; Italy (4) ; Burma (36 ; Java (41) ; Japan (20) ; Fiji (4) ; Belgium (2) ; India (138) ; F. M S. (75) ; Portugal (3) ; China (2) ; Russia (2) ; Cochin China (5) ; Africa (50) ; America (25) ; Australia (31) ; East Indies (6) ; West Indies (29) ; Pacific Islands (1) ; Hawaii (8) ; New Caledonia (1) ; Egypt (4) ; Bahamas (1) ; Gold Coast (10); Holland (7) ; Dutch East Indies (8) ; Philippine Islands (10) ; Solomon Islands (7) ; Mauritius (3) ; Seychelles (5) ; Borneo (10) ; Uganda (8) ; Cook Island (1).

BOARD OF AGRICULTURE.

The death occurred during the year of CAPT. A. N GALBRAITH, C.P.R.C., a former Secretary ; the HON'BLE MR. JAS. VANLANGENBERG, K.C., a Vice President ; MR. ANDREW RUTHERFORD, M.A., Government Entomologist ; and DR. R. H. LOCK, M.A., D.Sc., who acted for a time as Organising Vice-President.

At to-day's meeting a revised list of Board Members nominated by His Excellency the President will be submitted for the year 1915-16.

FINANCIAL.

A statement of income and expenditure is tabled as usual. The excess of purchases over sales under "Seed Sundries" was due to special expenditure on the free distribution of seed at the commencement of the war. In previous years the reverse was the case. Travelling expenses show a decrease by Rs. 2,000, compared with last year's expenditure, due to rigid economy necessitated by the retrenchment policy ; while the printing account has been reduced by Rs. 1,291·49 for the same reason.

The income during the 12 months under review exceeds the amount of the Government subsidy by 13,939·29, indicating that the Society is steadily making headway—a fact which should gratify its members. The activities of the Society have of course to be regulated according to the resources at its disposal, and under normal conditions there would have been opportunity for considerable expansion in the scope of our work : but under existing circumstances, and in view of our satisfactory financial position, Government has thought it wise to cut down the grant by Rs. 5,000, so that for a time at least it will be necessary to exercise extreme caution in incurring expenditure.

STAFF.

During the year the Secretary visited 168 centres in the different Provinces, inspecting the work of the Instructors, visiting the Gardens conducted under the auspices of the Society and conferring with officials and private individuals connected with the Agriculture of the Island.

The Society is now employing only 9 Instructors, the number being temporarily kept down in accordance with the general policy of retrenchment in operation at the present time. The movements of the Instructors have also been restricted on the same grounds.

MR. K. CHINNASWAMIPILLAI who was seconded for duty as Foreman of the Dry Zone Experiment Station, Anuradhapura, reverted to his substantive post as Agricultural Instructor, Batticaloa, on 1st February, 1915. MR. CHINNASWAMIPILLAI's training and experience in South India enabled him to put in some excellent work in the laying down of a series of dry-land crops at the Experiment Station, and should stand him in good stead in the district in which he is now serving where the climatic conditions approximate closely to those of South India. Already his knowledge and advice as to agricultural practice have come to be appreciated and sought after, and some interesting schemes affecting crops and cattle are likely to be launched with his assistance.

MR. L. A. D. SILVA, Agricultural Instructor, Balangoda, was for three months on special duty at Bandaragama and has since returned to his station where his chief charge is the excellent garden he has established, in addition to itinerary work in the Ratnapura district.

MR. L. de Z. JAYATILLEKE, Agricultural Instructor, Kosgoda, itinerated in the Galle District in addition to supervising the Weragoda and Bandaragama Gardens.

MR. S. S. MAPANAR has acted with acceptance as Agricultural Instructor at Jaffna for MR. S. CHELLIAH, since the latter's appointment as Maniagar of Delft, and supervised the work in the Jaffna Garden.

MR. A. A. JAYASINHE was stationed at Hettipola and looked after the Garden there, paying periodical visits to Puttalam, Nikaweratiya and Wariapola.

MR. M. J. A. KARUNANAYAKE, with headquarters at Hambantota during the cultivating season and otherwise at Matara, was in charge of the work at Ambalantota and Tissamaharama.

MR. A. MADANAYAKE was stationed in the North-Central Province, but was unfortunately incapacitated by malaria for a considerable period.

MR. JAS. R. NUGAWELA continued to work in the Central Province with headquarters at Katugastota and devoted his time chiefly to paddy experiments while inspecting the Mediwaka Garden at intervals.

MR. W. MOLEGODE, now Senior Instructor, has been of considerable help to me in the office, and was entrusted with special duties of a responsible nature. He also looked after the Kegalle Garden, and attended to work connected with lac culture.

All the Instructors were on special duty for a period of five weeks during which they worked strenuously in connection with the general distribution of seeds, at the end of last year, under a scheme for encouraging the cultivation of quick-growing crops to meet any possible shortage of food stuffs as the result of unemployment following upon retrenchment during war time.

OFFICE.

With so large a clientele as is indicated under membership the Society's office has had a great volume of correspondence to deal with. The number of letters that were despatched and received during the year were respectively 6,020 and 5,873.

The work could not have been carried on satisfactorily but for the services of a well-trained staff.

MR. J. S. DE SILVA, the Chief Clerk, who joined the Society at its inception, has a thorough grasp of the duties of his office. MR. W. A. W. GUNAWARDENE and MR. V. RAMANATHAN (Assistant Clerks) maintained their good record. No less efficient have been MESSRS. A. C. MACK (personal clerk to the Editor of the TROPICAL AGRICULTURIST), A. DE ALWIS and K. B. HALANGODA (Junior Clerks). In July MR. ALWIS succumbed to a painful illness and through his death the Society has lost a conscientious officer.

APPOINTMENT OF INSTRUCTORS AS CHIEF HEADMEN.

MR. S. CHELLIAH, Agricultural Instructor, Jaffna, was appointed Maniagar and President of Village Tribunals, Delft, and assumed duties on February 1st, 1915, his place being temporarily filled by MR. S. S. MAPANAR.

MR. P. B. M. BANDARANAYAKE, Agricultural Instructor, Badulla, was appointed Ratemahatmaya of Bintenne (E. P.) and assumed duties on May 1st, 1915.

The appointment of officers with agricultural training and experience to responsible posts in which they will have ample scope for dealing with questions affecting the welfare of a rural population and initiating measures for the improvement of its agricultural practices, is a most welcome innovation, and is bound to result in far-reaching benefits to the cultivating classes. Both the districts referred to are agriculturally in a backward state, and it will be interesting to watch their progress under officers who have special qualifications for dealing with rural problems.

Bintenne, the largest division of the Eastern Province, with a sparse population of some 3,000, is the home of a simple peasantry who practise the crudest methods of cultivation and are frequently confronted with serious difficulties in respect of food requirements. The possibilities of a larger and better food supply exist and are only awaiting development. The deep interest which the Government Agent (MR. BERTRAM HILL) has taken in this part of his province has led to his initiating a well-thought-out scheme for encouraging a better and more reliable system of cultivation with the use of irrigation water in place of the haphazard and improvident methods in vogue; and with the co-operation and sympathy of an agricultural Headman the future of the district is more hopeful than before.

In Delft, an Island of 17 square miles, very little agricultural work is carried on. With the exception of small cultivated patches the Island is in a state of nature. Some 20 or more years ago cotton was grown to a fairly large extent, and a perennial variety is still to be found successfully combating the drought that prevails during the greater part of the year. The lint from this is spun into an inferior thread and sold in Jaffna. A better variety of cotton will be tried next season. The most promising industry, however, is that of breeding animals (which include a few horses). There is ample pasture, and apparently much scope for improving the breed of cattle, sheep and goats: and this matter is engaging the attention of the new Maniagar who is working in co-operation with the Society,

It is to be hoped that the policy here indicated of appointing men trained to agricultural work to take charge of the backward districts of the Island will be pursued, so that through the agency of such "missioners" the standard of cultivation in these districts may be raised and greater uniformity may prevail in a Colony wherein the contrast of prosperous and depressed areas is so extraordinarily marked.

GARDENS.

The Society's Gardens continue to exercise an influence for good as experiment and demonstration centres, as well as media for the dissemination of new and improved varieties of crops.

At BALANGODA the garden is divided into six sections—School Garden proper, Vegetables, Fruits, New Economics, Fodder and Nursery. A large quantity of seed and plants were distributed during the year.

The MEDIWAKA garden is worked on a four-course rotation under a scheme for demonstrating the continuous cultivation of dry lands. The extent of two acres is divided into half acres and the following sequence adopted: Cotton, Legume, Cereal, Rootcrop.

During the past year the crops grown were Cambodia cotton, *Vigna sinensis*, Hickory King maize and Potatoes.

The BANDARAGAMA Garden was extended by the planting up of further rows of fruit trees, both grafts and seedlings, and though the larger part of the fruit section is devoted to oranges, the collection of plants is very representative. The locality being suitable for mangosteens, arrangements have been made for putting in a good number of these plants. About an acre is under pine-apples which are doing very well.

The WERAGODA Garden now carries a large number of introduced varieties of mangoes and oranges which are coming into bearing, and about a hundred "Gootee" layers are about to be taken off them. Among the fruiting trees is an excellent variety of Citron with edible peel. The fertility of the vegetable section is being maintained by green crop manuring with *Sesbania aculeata*. Jak planted mainly as a wind break is making good growth, and pine-apples cover about three acres.

At AMBALANTOTA after the removal of cotton, Egyptian sorghum and Castor oil, the garden has been got ready for sowing sunn hemp as a renovating crop.

The JAFFNA Garden is of a mixed character and is being cultivated with crops new to the Peninsula.

At TISSAMAHARAMA there is a plantation of fodder grasses with a view to introducing their cultivation into the locality where the question of cattle food is a pressing one.

The Garden at HETTIPOLA is worked on a four course system as at Mediwaka. The crops grown last year were Cotton, *Phaseolus radiatus*, Maize, and Cassava. Vegetables were grown in a separate section during the off season.

DISTRIBUTION OF SEEDS AND PLANTS.

Not the least important work of the Society is that accomplished through the half-yearly distribution of seeds and plants. During the past year, according to records kept, 1,726 plants and 6,164 seed packets went out from the nurseries and seed store in charge of MR. M. J. FERNANDO, the Seedsman. According to a recent census the number of seedlings of all kinds in the Stock Garden nurseries was 4,993.

The Society being in close touch with agricultural departments and agencies in all parts of the world is able to procure for its members any plant or seed they are in need of. In this way seeds of such rare plants as Durango,

and Cauto cotton, Hopi maize, and perennial rice have been introduced through the kindness of foreign correspondents.

In addition to the half-yearly distribution of seed the general "War distribution" referred to elsewhere should be mentioned here. For this work the Finance Committee voted a sum of Rs. 1,000. The task which the Society undertook was no light one and taxed its resources to the utmost. The co-operation of the Department of Agriculture was of great assistance in accomplishing the work, the result of which is seen in the abundant supply of vegetables in both town and village markets.

THE VALUE OF CO-OPERATIVE WORK.

A striking instance of the agricultural improvements effected in certain districts by this means is to be seen in Upper Dumbara Here, with Mediwaka as a centre, a great deal of useful work has been done in the introduction of new crops and better methods of cultivation. During the past five years the advantages of a rotation of crops has been demonstrated at the Mediwaka Garden which is subsidised by the Society. This garden is under the management of D. U. BANDA, Teacher of the Government School, and worked under the supervision of MR. W. MOLEGODE, Senior Agricultural Instructor. Both manager and supervisor have been keenly interested in the work, and the country around has greatly benefited by their labours. Cotton (Allen's and Cambodia), Tobacco, Hickory King maize, Sorghum (Indian and Egyptian) Onion (grown from seed), English potatoes, the cluster Sweet Potato, Coriander, Cow pea, etc., have been successfully raised and their cultivation taken up in the locality.

In connection with fruit culture the Society has had similar good fortune in discovering an enthusiast in MR. N. A. S. JAYASURIYA of Weragoda in the Southern Province. Though nearly 70 years old, MR. JAYASURIYA's energy and intelligence are remarkable, and to the Weragoda Garden he devotes all his time and attention without any cost to the Society. Here a large and representative collection of fruit trees of local and introduced varieties has been established from which layered plants are now available for propagation. In addition there is in season a nicely cultivated garden of annual crops where experiments directed by the Society are also carried out.

In the Pasdum Korale the Mudaliyar, MR. J. A. WIRASINGHE, heartily co-operated with the Society in the upkeep of the Bandaragama Garden, while MR. AMERASEKERA Mudaliyar, Magam Pattu, closely identified himself with the Society's work in Hambantota ; and in the Kandy district MR. K. B. BEDDEWELA rendered valuable assistance in connection with paddy cultivation and lac culture.

If the Society can rely upon the co-operation of more of its members, there need be little fear that its efforts on behalf of the cultivating classes, and particularly the small native cultivator who is most in need of assistance, will not fulfil the object with which those efforts were conceived, viz., to increase his produce and bring prosperity and contentment to the goiya.

PADDY.

The results of the Society's work in paddy were published in the form of a Bulletin in May last. Since then the following results are available :—

Transplanting.

Centre.	Spacing.	Yield per Acre in Bushel Ordinary.	Yield per Acre in Bushel Transplanted.
Mediwake (Upper Dumbara)	3—4 plants 6 in. × 6 in.	35	50

	Manuring.		
Walalla (Lower Dumbara)	600 lb.	104 bus.	920 straw
	White Castor cake.		
Do	Nil.	58	620
Mediwaka	Sunn hemp sown in field and cut in 2 months.	60	580
Do	Nil.	35	300

The experiment in transplanting confirms the experience previously gained (as will be seen from results given below) that planting 3 or 4 seedlings with a spacing of 6 inches gives a yield which in the Kandy district has never been less than 50 bushels per acre and is sometimes as high as 90 bushels.

Centre.	Method.		Yield per acre in bushel.
Gallella	3-4 Seedlings	6 × 6 ins.	60
Watawala	3 do	do	57
Do	4 do	do	60
Nugawela	3 do	do	52
Do	4 do	do	51
Peradeniya	3 do	do	90
Nugawela	3 do	do	63 1/3
Do	4 do	do	53
Galasiyapattu Korale	3 do	do	52

The following introduced paddies were grown during the year :—

Source.	Name.	Age.	Centre.
India	Vadan Samba	4 months	Dry Zone Station
Queensland	Upland	5 do	Kandy and Chilaw
Egypt	No. 1.	5 do	Nugawela
Egypt	Fino	5 do	Hiyarapitiya
Do	Sebeneri	5 do	Hanguranketa
Do	Yapani	5 do	Jaftna
Do	Sultani	5 do	Hanguranketa
India	Kuruvi	2½ do	Matale North
Manilla	Macan	179 days	Ratnapura and Kandy.
Do	Inasimang	169 do	
Do	Mulanay	143 do	
Do	Piniling Daniel	171 do	
Do	Panie	144 do	
Do	Hacan Pina	143 do	
Do	Senora II	143 do	

Different varieties of paddy (e.g. Hatiel, Mudukiriel, Hondarawala, Elwi, Henati, Kaluwi, Ratawi and Suduwi and Hill paddy) were sent out of the Island in response to applications received.

It is interesting to read in connection with experiments in Mauritius the following yields per acre secured from Ceylon paddies :—Mudukiriel 2,664 lb., Sudu elwi 1907, Kaluwi 1,447 lb.

The following exchanges of seed paddy were effected :—

Ambalangoda to Kalutara—Carolina.
Kandy to Matara—Heenati.
Matale to Nikaweratiya—Balawi.

Early this year the Society offered prizes for the best cultivated fields in Harispattu and Hewaheta. The arrangements in connection with this competition were in the hands of MR. W. MOLEGODE who, with the assistance

of MR. J. R. NUGAWELA, closely followed the details of cultivation. The Secretary also visited the competing areas and helped in the final selection.

The prizes consisting of silver medals were presented by the Hon'ble the Government Agent of the Central Province at the meeting of the Society held in Kandy on May 25th, 1915. The competition naturally created much interest among cultivators and the awards gave great satisfaction. In view of this result it is intended to offer similar prizes next year also.

Since paddy is seldom cultivated with paid labour, the following statement furnished by MR. W. MOLEGODE of the actual expenditure incurred in the cultivation of an acre of paddy land, and the return from it, should prove of interest.

Statement showing Expenses incurred in the Cultivation of 1 acre of paddy land in Dunuwile and the returns.

EXPENDITURE.

1.	Clearing "Wanethes," and Water Courses, 4 men					@ -/50	- 2·00
2.	1st ploughing and cutting ridges, etc. 2 pairs buffaloes					@ 2/-	- 4·00
	do do do 6 men					@ -/50	- 3·00
3.	'Ketuma' (hoeing) in lieu of 2nd ploughing 15 men					@ -/50	- 7·50
4.	3rd ploughing, levelling, draining, etc. 2 pairs buffaloes					@ 2/-	- 4·00
	do do do 6 men					@ -/50	- 3·00
5.	Transplanting				per pela	@ 2/50	- 5·00
6.	Harvesting 10 men	@ -/50	-	5·00	8 women	@ -/30	- 7·40
7.	Threshing 4 buffaloes	@ 1/-	-	4·00	4 men	@ -/50	- 6·00
8.	Winnowing 6 men	@ -/50	-	3·00	5 women	@ -/30	- 4·50
9.	Preparing threshing floor,				2 men	@ -/50	- 1·00
10.	Cost of seed 2½ bushels					@ 2/50	- 6·25
11.	Bundling 600 bundles straw					@ -/25	- 1·25
							54·90
					Profit -.		82·10
							137·00

RECEIPTS.

1.	64 bushels Paddy	per bushel	@ 2/-	- 128·00
2.	600 bundles Straw	per 100	@ 1/50	- 9·00
				137·00

TOBACCO.

The prospects of a better market have improved considerably since the advent of MR. B. SCHERFFIUS, the tobacco expert, whose first season's work at the Jaffna Farm has yielded very promising results. The hopeful view which MR. SCHERFFIUS entertains of the Island's possibilities in this connection may be taken as an assurance of the fact that with proper cultivation and under skilled control the leaf produced in Ceylon ought to find a place in the European market. Samples of cigar, pipe, chewing and cigarette tobacco have gone to England for examination and report.

The general interest aroused in tobacco is evident among both Europeans and natives in localities where tobacco is grown; while locally made cigars of a decidedly improved type are now obtainable at moderate cost.

COTTON.

For cotton the outlook is by no means bright. At present there is no local agency to foster the industry, and though it has been shown that in the drier parts of the Island cotton of excellent quality can be produced. there is not sufficient inducement either for the capitalist or small land owner to embark upon the enterprise.

Allen's long staple and Cambodia have both done well—the former in Hambantota and the latter in Dumbara. A trial was also made with Durango and Cauto cotton, the first of which gave excellent results in Anuradhapura. The Manager of the Experiment Station, Peradeniya, reported on the lint as strong, silky and of first class quality.

Though Kapok is not cultivated systematically, a large number of landowners have made a point of growing it along their boundaries in view of the good prices ruling. Exports fluctuate extraordinarily as the following figures kindly furnished by the Hon'ble the Principal Collector of Customs will show :—

1904—177,568 lb. ; 1905—152,650 ; 1906—263,793 ; 1907—309,583 ; 1908—214,465 ; 1909—193,175 ; 1910—256,776 ; 1911—339,126 ; 1912—572,065 ; 1913—239,115.

The largest importers are the United Kingdom, British India and Belgium.

POTATOES.

The Cluster Sweet potato introduced by the Society has become extremely popular and is extensively grown in the Central, Southern, Western and Sabaragamuwa Provinces. At the Mediwaka Experimental Garden a crop of 5,000 lb. was secured from an acre. The crop can be lifted in 4 months. The average price of sweet potatoes is about 3 cents per lb. in the local market which works out at Rs. 150 gross return per acre. Deducting Rs. 40 as the cost of cultivation and another Rs. 40 for cost of delivering at a market centre, a profit of Rs. 70 per acre is possible under favourable conditions. In Mediwaka alone over 30 acres are under this crop this year. In Harispattu and Dumbara this variety is taking the place of the common strains.

Little has been done in the systematic cultivation of the ordinary potato outside the Nuwara Eliya district, but the efforts of the Society in encouraging the growing of varieties acclimatised in India are likely to result in a good part of the Colony's demand being met by local cultivation. The importation of potatoes is very large, the tubers coming over from Southern Europe, the Australian Commonwealth and India. At the present time owing to a shortage of deliveries the price per lb. is almost prohibitive.

Solanum commersonii potato, introduced by the Society some years ago, has established itself as a superior variety. Mr. JAMES NOCK, Curator, Hakgala Gardens, reports having received one tuber from the Society in 1909, and kindly furnishes the following details of recent results : 42 lb. of tubers were planted on January 25th, 1914, and dug up on the 7th March, 1915, the yield being 171 lb. off 927 square ft., or roughly 3 tons per acre. Cattle manure was used and the sets planted 9" apart and 6" deep, in rows 2 ft. apart. A considerable amount of damage was done by black grub during the early stages of growth; and but for this the crop would have been much larger. A distribution of tubers kindly supplied by MR. NOCK has been made to suitable School Gardens in the Uva and Nuwara Eliya districts.

ONION CULTIVATION.

Onion cultivation is steadily extending though not as fast as can be wished, seeing that last year no less than 294,376 cwt. were imported into the Colony ! School gardens are acting as centres for the spread of the cultivation and proving the economy of using seed instead of bulbs for propagation. The heavy cost of seed-bulbs is undoubtedly one of the chief drawbacks to extended cultivation.

The Teacher of the Government School at Udispattu who sowed seed on October 10th, 1914, and transplanted on November 15th, lifted his crop on February 22nd, 1915, and secured a yield which worked out at 10 cwt. per acre.

LAC.

In May last, MR. MOLEGODE made a personal enquiry into the lacquer-work industry in Tangalle. He proceeded to Angurumaduwa, which is the centre of the industry, and took with him a quantity of brood lac for inoculating suitable trees found in compounds of the lacquer workers. He also instructed seven workmen in the method of lac cultivation. There were five families employed in the industry, who secured their necessary supply of wild lac with difficulty, at a cost of nearly Rs. 4 per lb. of prepared lac. It is roughly estimated that three seers of lac are required by a family per month ; and that a family consisting of parents, two sons and two daughters could utilise not less than 5 seers a month if that quantity were available. The market for lacquered articles is good, and if an enterprising agency took up their sale, the industry which seems to be dying out could be revived, as has been done in Hapuwida, Hurihikaduwa and Attaragama in the Central Province through the help of the Kandyan Art Association.

MR. MOLEGODE subsequently visited the Northern Province where the prevalence of Zizyphus trees offers facilities for establishing lac. Inoculation has also been done at the Government Stock Garden (Colombo), Kurunegala, Nugawela and Beliatta.

The best results so far have been secured on Maligatenne Estate, near Kandy, where MR. K. B. BEDDEWELA is making a special study of the subject.

APICULTURE.

There is nothing special to report under Apiculture except that hives of *Apis Indica* continue to be kept at the Stock Garden. Hives of the same bee have also been started by the Manager of the Experiment Station, Peradeniya.

MR. SHANKS who was of great service in our early experiments still continues his interest in this work.

The Society has recently placed itself in communication with an expert in Northern India, LIEUT. F. S. COUSINS, who is adviser to the Punjab Government. He is interested in the comb foundation turned out by the machine specially made for the Society in America and is giving it a trial in his hives. MR. SHANKS, as well as the Manager of the Stock Garden, has found the foundation satisfactory. The chief difficulty in its manufacture is the scarcity of good wax.

SERICULTURE.

In a circular letter from Downing Street, the Secretary for the Colonies invites attention to the article in the IMPERIAL INSTITUTE BULLETIN on the "Possibilities of Sericulture in British Colonies and Dependencies," and suggests consideration of the question whether steps could not be advantageously taken for fostering and encouraging the silk industry.

At the request of the Director of Agriculture the Secretary submitted the following note which reviews the situation in Ceylon :—

"An attempt to establish silkworm rearing as a cottage industry in Ceylon was made by the Ceylon Agricultural Society soon after its inception in 1904.

"A site near Peradeniya Junction, some 7 acres in extent, was leased from the Railway Department for a silk farm, and the services of MR. PERCY BRAINE, who had made a special study of sericulture, were engaged for a term of years. He gave attention chiefly to the Mulberry worm, but as the extinction of the pupæ is a *sine qua non* for reeling the silk, the rearing of these worms did not find favour with the Buddhist population in view of their religious scruples against the taking away of life.

"Subsequently the Society introduced the rearing of the Eri silk worm, of which the moth is allowed to escape as the cocoons are not reeled

but treated as waste silk. For a time the rearing of the Eri worm was carried on at a large number of village schools, but owing to the want of a ready market it was gradually given up.

"Though the Society further sought the co-operation of the Salvation Army in the conduct of the silk farm with a view to reviving an interest in sericulture the results were not encouraging.

"One of the reasons why silkworm rearing has not taken root in Ceylon is that it is not particularly attractive from a financial point of view to our village population who live under comparatively easy conditions compared with their Indian brethren.

"With a ready market, however, and fair prices (say Re. 1 per lb. on the spot) for cocoons, there should be better prospects of making sericulture a cottage industry.

"The Mulberry grows well in the island, and the Silk Farm has been planted up with a good variety which could always furnish material for propagation, while the castor oil plant grows like a weed in most parts of the Island : so that there should be no difficulty at any time in establishing a food supply for Bombyx and Attacus silkworms, both of which have been found to thrive well if conditions are otherwise favourable.

"The Society makes a point of keeping up the breeding of worms on a limited scale to meet any demand for eggs.

"At the Home for Vagrants in Colombo, the Salvation Army employs the less able-bodied inmates for sericultural work, and with the assistance of one of its trained officers spins the silk into fabrics."

RECLAMATION OF SALINE LANDS.

The difficulty of cultivating saline lands is a problem with which the cultivator is frequently confronted in the North and other parts of the Island ; and the improvement of saline fields for paddy is a matter of considerable importance in tidal areas, as for instance in the vicinity of Alutgama.

At the request of the Secretary a short memo. on the methods in vogue in Western India was kindly prepared by the Deputy Director of Agriculture, Konkan Division, and is here reproduced for the benefit of members who have from time to time applied for information on the subject:—

"The reclamation of these lands is done by erecting bunds to keep the water out at high tides. The bunds are usually made of mud, and in few cases is there any masonry. Exits are left in the bunds to let out excess water during rains. In some cases the exits are fitted with sluices, which are open at low tide and closed at high tide. The exits are closed with mud during the hot weather, the object being to keep out the water, which is more saline in the dry season, from getting in. In the first two or three years deep drains are made at regular intervals to drain the excess of salt from the land.

"*Methods of Cultivation.* (1)—*Kola Gazni system.*—In this the openings of the embankment are not closed throughout the year. The salt water enters the land at high tides. The cultivation of the land is commenced just before the sowing which takes place when the water in the river gets sweet. At low tide the earth is turned over and sprouted seed broadcasted. These lands are liable to be damaged by flood if they continue long, and by salt water in case of drought. (2)—*Hulihetti system.*—In this system the openings in the embankments are shut up in the month of March. Until then salt water is allowed into the land. The exits are closed at low tide when all the water is out of the fields. The land is allowed to dry for a fortnight and then dug up. As soon as the river water becomes sweet, openings are made to let in sweet water and the land again dug up and the seed broadcasted. These two systems do not provide against damage by flood or drought.

(3)—*Thimanu system.*—In this the embankments are fitted with sluices, and are sufficiently high to keep off floods. The land is dug up in the hot season and sown as soon as the rains set in. It is not necessary to wait till the water becomes sweet. In case of drought, river water so long as it is sweet is taken in and then shut off. If there be a good supply of spring water, spring rice is also cultivated on such lands."

In the North Konkan the cultivation of salt lands with paddy differs to a certain extent from the sweet lands. Salt lands are not ploughed in puddle like the sweet lands. Very little cultivation is given and it is completed during the hot weather when the fields are dug up with crow-bars. The soil, being very clayey, comes up in large clods and these are turned over. The borders of the fields just inside the bunds are excavated and the soil is placed on the bunds. This finishes the cultivation.

Varieties.—In the early days of reclamation "Rata" and "Morchuka" (both red rices) are sown broadcast in the fields, but as the land tends to become sweet, "Maugarwel," "Dodki" and "Ekchodya" (white rices) are sown.

Sowing.—The salt lands are generally sown broadcast in June at the commencement of S. W. monsoons and no transplanting is done. Sprouted seed is generally used, but in fields where water does not stagnate till the seedlings come up, dry seed is sown. Broadcasting of sprouted seed is done in about ¼ inch of water. It is best to sow in cloudy weather. The seed should not be exposed to the sun. For dry sowing about 60 lb. and for sprouted seed about 30 lb. of seed are used per acre.

As the seedlings grow up more water is allowed in the field until it is about a foot in height, after which the excess is drained off. The fields are weeded when the crop grows to about 12 in. to 18 in. In weeding the fields seedlings that have sprung from seed that had fallen at the time of the previous harvest should also be removed. The seedlings should be thinned out from places where they are thick, and planted where wanting.

No further care except the regulation of the water supply, which is solely supplied by rain, is needed.

"Rata" is the early variety and is harvested in about 110 days. "Morchuka" takes about 120 days. "Dodki" and "Ekchodya" are reaped in about 140 days, while "Maugarwel" takes over 155 days.

Salt-land paddy is harvested just after the sweet-land paddy. The yield per acre is at first 600 to 800 lb., but this increases to over 2,000 lb. when the land is completely sweetened.

AGRICULTURAL EDUCATION.

At the last Annual Meeting the question was raised as to whether, in view of the postponement for the present of the larger scheme for an Imperial College of Agriculture, it would not be wise to launch a more modest institution of the nature of a School of Agriculture for the youth of the country, providing for classes both in English and the Vernacular. This idea is now taking shape, and the Director of Agriculture who has already matured his plans will probably be in a position to make an announcement at to-day's meeting.*

At the C.M.S. Training Colony in Peradeniya a short course of agriculture was undertaken by MR. MOLEGODE at the request of the authorities.

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* As anticipated the Director announced at the Meeting that arrangements had been completed for the opening of a School of Tropical Agriculture at Peradeniya in January next.—ED T.A.

PUBLICATIONS.

The TROPICAL AGRICULTURIST continues to maintain its position among the leading agricultural publications of the day, and no pains have been spared to make it worthy of its reputation.

The *Sinhalese* and *Tamil* magazines have been issued regularly and are up to their usual standard of efficiency. The former has a very wide circulation and as an educative medium is of the greatest utility.

As most of the old series of leaflets have gone out of print it has been decided to reissue revised editions of the more important leaflets in addition to new publications. Recent issues deal with the Society's work on Paddy ; Hints to Tobacco Growers, and Irrigation in Paddy Cultivation.

A Junior Agricultural Reader prepared by the Secretary is now in use in Government Village Schools. A second (Senior) reader is passing through the press.

MISCELLANEOUS.

The Society's pedigree Kangayam stud bull after remaining for a time at Walawa, where it covered 20 cows, was removed to Tissa and is in charge of the Mudaliyar.

Through the kind offices of Mudaliyar Naganather of Nuwara Eliya a consignment of "Suvandel" plantain, considered by many the finest variety, was sent free of cost to Jaffna, where it is said to be practically unknown.

For the following analyses, made by the Government Agricultural Chemist, of the cattle foods and fodders commonly used in the Island, the society is indebted to the Director of Agriculture :—

	Coconut Poonac.	Gingelly Poonac.	Mauritius Grass.	Guinea Grass.
Moisture at 100°F	11·7	10·80	83·0	63·38
Oil	14·6	13·40	0·21	0·84
Albuminoids	17·8	31·75	2·01	1·88
Carbohydrates	42·0	29·00	7·67	19·36
Woody Fibre	5·9	3·65	5·61	8·79
Mineral Matter	8·0	11·40	1·50	5·75
	100·00	100·00	100·00	100·00
Water soluble ash		1·50	0·89	
Nitrogen		5·08	0·33	
			Nutrition	1.11.3

In addition to the paddies (mentioned elsewhere) introduced by the Society the following seeds were also received and distributed during the year: Quawoon and Dudain melons from Egypt, Manketan melon from Cape Colony, *Carum copticum* and Senna from S. India, Potatoes (5 varieties) from Ootacamund, Soy beans (12 varieties) from Bangalore, African oil palm (3 varieties) from the Gold Coast.

LOCAL DISTURBANCES.

In the course of the year the Island experienced an unfortunate outburst of animosity between two sections of its inhabitants which led to dreadful excesses in the heartless destruction of property, necessitating the intervention of the strong arm of the law to suppress them. In these disturbances which wrecked the peace of many a village a great number of the agricultural population became involved, and as a result a certain amount of distress has occurred. To what extent this will affect agricultural pursuits has yet to be ascertained after the temporary disorganization of rural life has subsided. Certain it is that the sooner the villager resumes the care of his fields and gardens and makes an effort by honest toil to repair such losses as

he has sustained, the better for the rural community and the better for the country at large. It is, therefore, incumbent on all members of this Society to encourage in every possible way the speedy return to the land of those who through pressure from outside have been divorced from their peaceful avocations, and induce them once more to pursue the even tenour of their way.

It is to the leaders in the country districts, the landed gentry among the agricultural community, that we would specially appeal, to put an end to the jealousy that exists between class and class and show by their example that the honourable calling to which they and their less prosperous brethren belong does not recognise any rivalry but that which impels them to emulate one another as producers of the fruits of the earth—the food of the nations—wherein their sole duty lies, and lead them to appreciate to the fullest extent the blessings which they enjoy under an enlightened and beneficent Government which expects unswerving loyalty from all good citizens.

THE WAR.

The war in Europe which began early in the year under review still drags on, and the Colony is contributing its quota of fighting men towards the defence of the Empire. Those who remain behind to pursue the more peaceful arts of agriculture must realise that they too can do their duty by the State by making the effort which the situation demands to develop to their fullest extent our great natural resources with the assistance which science can afford.

"Not all by battlefield and wave
His country's shield can hope to stand:
He serves no less who toils to save
The harvest of his native land."

CONCLUSION.

The work of the Society for the past year as reviewed in this report has not, it will be seen, overlapped that of other Associations connected with the agriculture of the Island, which however are chiefly concerned with estate products. The interest of the Ceylon Planters' Association is divided between Tea, Rubber and Cocoa, while that of the Lowcountry Planting Association may be said to be centred on coconuts. The subjects dealt with in this report are therefore complementary to those treated of in the reports of the two Associations referred to: and in this way do the three bodies co-operate to cover the varied field of tropical agriculture.

To the Director of Agriculture, who is the organizing Vice-President of the Society, the Secretary is greatly beholden for advice and guidance; to the Government as its Patron and HIS EXCELLENCY THE GOVERNOR as its President the Society would return its most grateful thanks for assistance and encouragement.

C. DRIEBERG,
Secretary, Ceylon Agricultural Society.

Peradeniya, 31st August, 1915.

SACRED TREES OF THE TROPICS.

[*Illustrated.*]

The worship of certain plants or trees, supposed to possess supernatural qualities, has been at one time or another practised in many parts of the world, and the custom has still survived to a large extent among certain races in tropical countries, more especially in the Eastern tropics. In India the number of trees or plants which are held sacred, or are specially esteemed for temple offerings, is fairly extensive, and many are the fables and stories

current among the masses alluding to their mysterious properties and their association with the spirits or the gods.

How such trees come to be singled out for preference is not generally clear to the uninitiated, although no doubt special selective qualities may be indicated in each case. They are not necessarily indigenous, for certain introduced species are equally sought after, as for example the *Plumeria* of South America, now commonly cultivated throughout the East and popularly known as the "Temple tree." As a general rule the production of showy or strongly scented flowers, as in the case of the last named, or the presence of a powerful aromatic odour in the leaves would seem to be essential characteristics. *Ficus religiosa*, or Bo-tree, is, however, an exception in this respect, for it bears no flowers in the ordinary sense of the word, neither is it in any way scented; but on the other hand, it is well adapted for growing near buildings or among ruins, and being of a large spreading habit affords grateful shade and shelter.

The origin of the custom of tree-worship may thus be traced to the effect on the senses, more especially those of sight and smell, and the degree of veneration is generally in proportion to the extent, though perhaps unconsciously, of these factors. Similarly the burning of incense, which consists principally of odoriferous gums and resins, and has been associated with certain Christian religious rites from remote ages, has had a like origin. The Israelites employed fragrant herbs in their thank offerings, while the Romans and Egyptians burnt spices at funeral ceremonies, or buried them with the dead.

PRINCIPAL KINDS.

The Bo-tree (*Ficus religiosa*) which belongs to the Banyan family, takes foremost place in the religion of the Hindus and Buddhists, and probably no other member of the vegetable kingdom in any country is the object of such intense veneration. Throughout India, Ceylon and Burma the "Bo," or "Peepul" as it is called in India, is the most venerated of all trees. A good Hindu who when on a journey sees a Peepul tree will take off his shoes and walk five times round the tree from right to left. "The Hindu who plants a Peepul tree does so expecting that just as he thereby affords shade to his fellow creatures in this world, so after death he will not be scorched by excessive heat on his journey to Yama." (Oudh. Gaz., 111. 345). It was under a Bo-tree that Buddha is supposed to have attained perfection. The history of the tree in Ceylon, where it is not indigenous but is now found growing at every Buddhist temple, is interesting from the fact that a specimen at the ancient ruin city of Anuradhapura is considered the oldest historical tree in the world, dating back more than twenty centuries and visited by thousands of pilgrims every year. Its original introduction into this country was effected by an Indian Buddhist princess (Sanghamitta), who with great ceremony came on a special visit to Ceylon to present a branch to King Tissa. The transport of the said branch and the planting of it at Anuradhapura, where it now forms the historical monument referred to, is recorded with much extravagant romance, the conclusion of the ceremony being said to have been marked by "numerous miracles and a quaking of the earth." The species is by no means naturally long-lived, but in this case the tree is perpetuated by a series of terraces built around it, one above the other.

The Bo-tree has now become so thoroughly naturalised in Ceylon as to have all the appearance of being indigenous. An aged specimen, with a rustic shrine piled around it for the offering of scented flowers, is a familiar sight in every town or village or at roadside halting spots. Supplementing the flowers, the shrine is sometimes embellished with small bright coloured candles, which are lit up at night. The Bo is distinct from all other species of Ficus by the long tadpole-like prolongation of the leaf tip. It is often an unsolicited visitor among buildings, seedlings having a special aptitude for becoming established in the crevices of walls and drains or behind rain pipes, and unless removed early will cause considerable damage and

Photo by H. F. Macmillan.

SAUSAGE TREE. *(Kigelia pinnata).*

See page 217

Photo by H. F. Macmillan.

THE SHRINE AT THE FOOT OF THE SACRED BO-TREE.

(Ficus Religiosa)

become difficult to eradicate. A devout Buddhist will do anything rather than injure, or cut a branch off, a Bo-tree; if it comes up as a weed in his garden and must be removed, the operation is carried out with due care and tenderness, the young Bo being ceremoniously transplanted elsewhere. In the event of a tree which is on the property of a non-Buddhist having to be uprooted, pruned, or mutilated, the job must be done by a person other than a Buddhist.

Aegle marmelos, the Bael fruit or "Beli," known in India as Bilva, is among the most sacred of Indian trees and is consecrated to Siva. It is one of the trees the planting of which by the wayside gives long life. "It is incumbent on all Hindus to cultivate and cherish the tree, and it is sacrilege to cut it down." The fruit is an effectual and well-known remedy in the East for dysentery.

Azadiracta indica is the well-known Nim or Neem of India, where the tree is held sacred. It is known in Ceylon by the Portuguese name Margosa, to the Sinhalese also as "Kohomba," and to the Tamils as "Vempu." It is an elegant tree, belonging to the natural order *Meliaceæ*, being indigenous to India and the northern part of Ceylon. It is commonly cultivated here, chiefly for the sake of its medicinal bark and valuable oil obtained from the seed. The latter, known as "Kohomba tel," is a universal external application for rheumatism, and is a common remedy for cattle. Here the Margosa is considered a lucky tree to grow near dwellings.

Butea frondosa is a beautiful flowering leguminous tree which is especially sacred to the Brahmins. It is indigenous to the plains of India and the northern part of Ceylon, being commonly known by the name Bengal Kino, also by numerous vernacular names, as Palas, Parasu, Duku, Moduga, Murrukka-maram (Tamil). In Ceylon it is called "Gas-kela." The botanical name is in honour of the third Earl of Bute, once Prime Minister of England. Nearly every part of the tree furnishes a useful product, including gum from the trunk, fibre from the bark, oil from the seed, a yellow dye from the flowers, medicine from the leaves, and an antidote for snake poison from the root and bark. So it is not perhaps surprising that such virtues should command some degree of reverence.

Cannabis sativa, well known by the names Ganja, Bhang, Indian Hemp, etc., is an annual plant of the Nettle family, supposed to be indigenous to India and Persia, but spread by cultivation throughout Asia and Africa. It has been cultivated from very early times both for its fibre and narcotic or stimulating properties. The leaves are smoked alone or mixed with tobacco, pounded into water and taken as a drink, or in other forms. The effect is to induce pleasant excitement or demented intoxication, which passes into delirium if the quantity be increased. The practice readily becomes a habit which, like the opium habit, is difficult to break off, and produces ultimately a form of insanity. The cultivation of the plant in India is regulated by law, and licensed dealers control the sale of the narcotic product; in Ceylon, Africa and other Eastern countries the cultivation of the plant is entirely prohibited under severe penalties. Ganja is sacred to the Hindus, and is associated with magical powers, having according to Hindu mythology, "originated as nectar from the sea while the gods were churning the ocean."

Kigelia pinnata, or "Sausage Tree," appeals to the religious sense of the natives of tropical Africa, where it is indigenous, presumably more from appearances than from any actual merit. The large curious-shaped fruits, which hang from the ends of long cord-like attachments, are distinctly of those which deceive the eye; they belie their popular name, for despite their suggestive appearance they are of a dry and woody nature, containing scarcely anything that is edible. The tree is nevertheless sacred to some African tribes *(see illustration)*.

Nandina domestica, "Sacred Bamboo," is a native of China and Japan, where it is almost universally grown in gardens, etc. It is sacred to the inhabitants of the countries named, and is commonly planted near temples and pagodas. It is not a bamboo, but a pretty shrub with fine tri-pinnate leaves, of the Berberry family, but its peculiar habit of sending up numerous straight unbranching stems from the root, as can be seen from the photograph, has obviously caused it to be mistaken for a kind of bamboo. It produces a large panicle of pretty creamy flowers. *(see illustration.)*

Nyctanthus Arbor-tristis is well-known to the Sinhalese by the Sanskrit name "Sepala" or "Sepalika," and to the Tamils as "Manja pu." In India it is known by numerous vernacular names, all befitting the supposed claims of the tree on the religious sense of the people who worship it. The plant is supposed to have been brought from heaven by the god Krishna for his wife Satyabhama. The flowers are much esteemed as temple offerings in India, Ceylon, and Burma. The tree, which belongs to the Olive family, is indigenous to India, but has been introduced into Ceylon and is commonly planted here in the vicinity of Buddhist temples. One of the dyes for the Buddhist monks' yellow robes is obtained from the flowers.

Nelumbium speciosum, the Sacred Lotus, known in Ceylon as "Nelun" and in India as "Kanwal" and other names, has attracted the attention of Hindus from a very remote period and is the most sacred of all flowers to Vishnu. It is also a very prominent flower in the religious ceremonies and mythological fables of Buddhists, figuring conspicuously in their paintings and works of art. The four-faced Brahma is supposed to have been born in a lotus, and the goddess Lakshimi is generally represented as seated in a lotus flower. Known as the "Sacred Bean" or Cyamus, the plant has been held sacred by the Egyptians from time immemorial, but has now become extinct on the Nile. It is equally venerated in Burma, China, and Japan, in which countries it is indigenous. The lotus is a great ornament of our low-country waters in Ceylon, often covering acres of tanks, etc., with its curious leaves and fruit and magnificent pink flowers. The large seeds are an article of food.

Ocimum sanctum, or Sacred Basil, is a small herbaceous aromatic perennial, of the natural order *Labiatæ*. This is the Indian "Tulsi," which is universally worshipped by the Hindus, especially by Vishnuites. It is well-known in Ceylon under the name "Maduru-tala," which means "mosquito leaf;" it is credited with the power of driving away mosquitoes, and is commonly found in native dwellings, being tied in bundles and hung from the rafters.

Plumeria acutifolia, commonly know in Ceylon as the "Temple tree," in Burma as the "Pagoda tree," and in India sometimes as Franjipani, is always planted near Buddhist temples and pagodas, the highly scented flowers being greatly esteemed as votive offerings. The tree nevertheless is a native of tropical America, but has been introduced in the Eastern tropics, where it has become naturalised and is very commonly met with in gardens, etc.

Prosopis spicegera, of the natural order *Leguminosæ*, is the Sami Tree (god tree) of the Hindus, by whom it is worshipped all over India. The death of a notorious Asura (demon) at the hand of Vishnu is celebrated yearly at the foot of this tree. It is said that some of the Hindu temple gods are taken on horseback once a year to commemorate this event.

Saraca indica, or "Asoka," a small beautiful Leguminous tree, bearing clusters of scarlet and orange-yellow flowers, is indigenous to India and Ceylon. It is one of the sacred trees of the Hindus, and its flowers are much used in temple offerings in India. The tree is a symbol of love, and is dedicated to Kama, the Indian god of love. It is believed to have a certain charm in preserving chastity. Thus Sita, the wife of Rama, when abducted by Ravana, escapes from the caresses of the demon and finds refuge in a grove of Asoka

Photo by H. F. Macmillan.

SACRED "BAMBOO." *(Nandina domestica).*

trees. The tree also figures in the legend of Buddha, when Maya seeks protection in a wood of "Asoka." The latter word signifies that which is deprived of grief.

Stereospermum xylocarpum is known in India as the "Padri tree," for reasons which do not seem clear. It is a large spreading tree, of the natural order *Verbenaceæ*.

H. F. MACMILLAN.

CEYLON CIGARETTES.

Some boxes of cigarettes made from Turkish tobacco grown at the Government Trial Ground, Jaffna, by MR. SCHERFFIUS were exhibited at the meeting of the Ceylon Agricultural Society on 31st August. We reproduce below some of the press comments on the cigarettes which will indicate how they were received :—

TIMES OF CEYLON.—"A distinctly encouraging incident in the agricultural development of Ceylon is the practical advance that has been made in tobacco cultivation. MR. D. W. ARNOTT in his report on the Blue Book for 1913 feared that 'unless improved methods of growing and curing are devised it seems unlikely that tobacco will ever become a staple industry.' At that time the great majority of people probably held the same view. To-day more optimistic opinions may justifiably be entertained. In order to test the possibilities of tobacco, Government appointed an expert planter and curer to carry out experimental cultivation, and after a year of diligent work a cigarette tobacco has been produced which HIS EXCELLENCY THE GOVERNOR has admirably summed up as "quite a good smoke," and coarse cut pipe tobacco of a quality that warrants a ready sale is available. This succesa does not, of course, warrant the hasty conclusion that the difficulties of the past have been overcome or that a new staple industry has already been founded for Ceylon. All that the experiments have accomplished so far is to prove that tobacco which deserves to have a real marketable value can if, grown on carefully selected ground under proper supervision, be produced in Ceylon. It would seem, too, that it can be placed on the market at a price that makes it a sound commercial proposition. The cigarettes, we learn, can be marketed at Rs. 2 a hundred and leave for the grower a return of about 60 cents (per lb.—Ed. "T. A."). This should be enough to encourage producers and it will certainly please consumers. The achievements, then, mark sound progress. They had laid a practical foundation on which an industry can be started, and it is an industry which ought to offer handsome profits. No Turkish or Egyptian cigarettes are made East of Suez, and Ceylon would have the benefit of a readily accessible market in India and the East. Locally, too, we imagine that a good cigarette at Rs. 2 per 100 would find a ready market. Tobacco cultivation then seems to be an industry which offers attractive possibilities. The next step lies in individual enterprise. Government has done its share. It has shown what can be done, and no doubt further experiments will continue to be made with a view to improving the quality and the methods of cultivation. But it does not come within the province of the Government to enter into trade and market the tobacco. This must be the work of private initiative, and now that MR. SCHERFFIUS has shown the way to make the tobacco it is to be hoped that the enterprise of the Government will be recognised by private initiative and that a thorough effort will be made to establish tobacco growing as one of our staple industries. It is evident it can be done."

CEYLON MORNING LEADER.—"The proceedings of the Board of Agriculture yesterday disclosed that a definite and highly satisfactory forward move has been made in the manufacture of locally grown tobacco and there is every assurance that, if the efforts which have recently been made in this direction are steadily maintained, a new era of prosperity is about to open in

this country. We have not the figures before us of the imports of tobacco and cigarettes into the Island but they form a very appreciable proportion of the trade of the country, and now that local manufacture has definitely passed the experimental stage, and its commercial possibilities are within practical realization, the planting and manufacture of tobacco bids fair to enter the lists of our staple industries. The production of a smokable cigarette out of the material locally available would have been scoffed at a few years ago by those acquainted with the conditions of soil and climate. But MR. SCHERFFIUS has performed the seemingly impossible, and those who have had an opportunity of sampling the Ceylon cigarettes, HIS EXCELLENCY THE GOVERNOR being among the number, have pronounced them as very good indeed. MR. SCHERFFIUS informed the Board yesterday that the tobacco out of which the cigarettes had been made was less than five months old, but as the Agricultural Society was in need of immediate opinion on it, they could not wait to age it for two years when the best results could be obtained. Despite this fact, and also that the curing had been done under very primitive conditions,a very excellent article has been produced."

CEYLON OBSERVER.—"The Department of Agriculture has produced an attractive Ceylon Turkish leaf cigarette, which is eventually to be put on the market. A number were on view at to-day's meeting of the Board of Agriculture and evoked general admiration."

CEYLON INDEPENDENT.—"The Ceylon cigarettes on which SIR ROBERT CHALMERS passed so favourable an opinion, should now take their place in the local market as a worthy rival of the foreign brands sold so largely in the Island."

PHYSIOLOGICAL CHANGES IN SWEET POTATOES DURING STORAGE.

H. HASSELBRING AND L. A. HAWKINS.

The results of the investigations conducted at Washington, D.C., with Jersey Big Stem and Southern Queen sweet potatoes are summarised as follows :—

During its growth the sweet potato root is characterised by a very low sugar content. The reserve materials from the vines are almost wholly deposited as starch.

Immediately after the roots are harvested there occurs a rapid transformation of starch into cane sugar and reducing sugars. This initial transformation seems to be due to internal causes and is largely independent of external conditions. Even at a temperature of 30° C (86° F) both cane sugar and reducing sugars accumulate during this initial period in excess of the quantity used in respiration, while during subsequent periods the quantity of reducing sugar diminishes at that temperature as a result of respiration. These initial changes seem to be associated with the cessation of the flow of materials from the vines.

In sweet potatoes stored at a temperature of 11·7 to 16·7°, the moisture content remains fairly constant. There is a gradual disappearance of starch during the first of the season (October to March) and probably a re-formation of starch accompanied by a disappearance of cane sugar during the latter part of the season (March to June). The changes in reducing sugar are less marked than those in cane sugar. The changes in starch and cane sugar appear in a general way to be correlated with the seasonal changes in the temperature,

In sweet potatoes kept in cold storage (4° C.) there is a rapid disappearance of the starch and an accompanying increase in cane sugar. These changes do not attain a state of equilibrium at that temperature, as the sweet potatoes invariably rot by action of fungi before the changes have reached their maximum. At both high and low temperatures cane sugar is the chief product formed by the conversion of starch in the sweet potato. The quantity of invert sugar in the root at any time is comparatively small.—

EXPERIMENT STATION RECORD.

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AN ILLUSTRATED HANDBOOK OF

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With Special Reference to Ceylon,

By H. F. MACMILLAN, F.L.S.,

Superintendent of Botanic Gardens, Ceylon.

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Photo by H. F. Macmillan.

DUMB CANE (*Dieffenbachia var.*)

Photos by H. F. Macmillan.

ISOTOMA LONGIFLORA

"RAT-NETUL," Sinh.

Plumbago rosea

(*See Page 263.*